EPIDEMIOLOGY AND FACTORS EFFECTING VISUAL OUTCOME IN OPEN GLOBE INJURIES IN CHILDREN AT A TERTIARY CARE HOSPITAL

A dissertation submitted in partial fulfillment of the MS branch III (Ophthalmology) examination of the Tamil Nadu Dr. MGR Medical University, to be held in April 2013

DECLARATION

I hereby declare that the investigations that form the subject matter of this thesis was carried out by me under the guidance of Dr Renu Raju, Professor of Ophthalmology, Christian Medical College, Vellore. This has not been submitted in any other university in part or in full.

Dr Mary Esther John B

Dept of Ophthalmology

Christian Medical College

Vellore.

Date: 17th December 2012

Place: Vellore

CERTIFICATE

THIS IS TO CERTIFY THAT THIS DISSERTATION ENTITLED "E*PIDEMIOLOGY AND FACTORS EFFECTING VISUAL OUTCOME IN OPEN GLOBE INJURIES IN CHILDREN AT A TERITIARY CARE HOSPITAL"* IS BONAFIDE WORK DONE BY DR MARY ESTHER JOHN B IN PARTIAL FULFILLMENT OF THE RULES AND REGULATIONS FOR M.S. BRANCH III (OPHTHALMOLOGY) EXAMINATION OF THE TAMILNADU DR. MGR MEDICAL UNIVERSITY, CHENNAI, TO BE HELD IN APRIL 2013.

DR RENU RAJU

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VELLORE

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Mary Esther John B

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AIM

To study the proportion of the types of penetrating ocular injuries in children and identify the risk factors for poor visual outcome.

OBJECTIVES

a) To study the proportion of open globe injuries annually among patients less than 18 years of age presenting to the department of Ophthalmology

b) To study the proportion of various types of penetrating ocular injuries.

c) To determine the factors influencing the visual outcome.

INTRODUCTION

Ocular trauma is a major cause of ocular morbidity and has been reported to be one of the most important causes of unilateral vision loss in children. [1,7] Children are more prone to injuries due to their curiosity, immature motor skills and increased physical activity.[24] Visual impairment in childhood is of greater significance as, in addition to physical disability, it has a major impact on social and psychological development of the child.[1, 18]

The American National Society for Prevention of Blindness has estimated that 55% of ocular injuries occur before the age of 25 years and one- third of vision loss in the first decade of life is due to ocular trauma[2]. Children less than the age of 8 years are at increased risk for poor visual outcome because of the threat of amblyopia.[6] Hence, it is important to determine the magnitude of the problem, identify the major causes of trauma and factors that effect the visual prognosis.

REVIEW OF LITERATURE

Ocular trauma is one of the leading causes of preventable monocular visual impairment and blindness in children all over the world .[26 ,29 ,31,33,42]Studies have shown that boys were more prone to injuries than girls due to their active and adventurous nature. [11,18,21,22 ,48]Children can cause injury to their own eyes when playing with dangerous toys like sticks, fireworks or missiles like bow and arrow, etc.[30, 39] Corneal tears were the most common type of open globe injuries. [22] Visual prognosis depends on the length of the tear and involvement of visual axis.[6,34,38] Most of the trauma in children occurred at home.[16,18.36,40, 49]

POPULATION BASED STUDIES IN CHILDREN AND ADULTS

Population based studies on ocular trauma in all age groups done in South India gives us information on the magnitude of the problem in our country.

A population based cross-sectional epidemiological study was conducted by the L V Prasad Eye Institute in the rural population in Andhra Pradesh in 7771 subjects. A total of 824 subjects gave history of ocular trauma in either eye. Seventy six subjects reported trauma in both the eyes. Trauma was responsible for blindness in 39 subjects. The overall age and gender adjusted prevalence of history of eye injury was 7.5% and prevalence of blindness due to trauma was 0.6%[3].

A similar study was conducted on urban population in Andhra Pradesh by the same institute. 2522 subjects were included in the study. 113 subjects gave history of trauma. The age and gender adjusted rate of ocular trauma was 3.97%. The prevalence of blindness due to trauma was 0.60%[4].

Another population based cross-sectional study conducted by Aravind Eye Care System in Madurai, Tamil Nadu included 5150 subjects. It was done in 3 districts. 229 subjects gave history of unilateral ocular trauma. Two subjects gave history of bilateral ocular trauma. The age adjusted prevalence for ocular trauma is 4.9% and the age adjusted prevalence for blindness due to trauma is 0.8%[5].

CLINICAL PROFILE OF OCULAR TRAUMA IN CHILDREN

DEVELOPED COUNTRIES

The clinical profile of open globe injuries has a direct implication in determining the visual out come and prognosis. A study was conducted at Birmingham, U K, to study the visual outcome of perforating eye injuries in children (96 cases). The study had an approximate ratio of 4:1 boys to girls. Poor visual outcome in corneal tears were associated with involvement of the visual axis resulting in corneal scarring and/ or significant astigmatism, if it involved greater than one fourth of corneal diameter, or non-compliance with spectacles in patients younger than 8 years of age. Injuries involving the lens in those younger than 8 years are associated with worse prognosis due to the problems of correcting aphakia . The study showed that surgical delay did not affect the visual outcome. Of the 96 patients reviewed in this study 15% failed to achieve 6 months of follow-up. The other cases which were followed until 10 years showed that ocular sequelae like lens damage, central corneal scarring and astigmatism affect the long term visual outcome.[6]

A retrospective analysis of open globe injuries was done in children in The Johns Hopkins Hospital, Baltimore. Between January 1970 and January 1993, 180 eyes of children who presented with open globe injuries were retrospectively analyzed. The patients were divided into 2 groups. One group of children underwent treatment of an open globe injury between January 1970 and December 1981, and another between December 1985 and January 1993. Main findings of the study were:

i) The ratio of boys to girls was 5:1.

ii) A strong indicator of final visual outcome was the initial visual acuity at the time of presentation.

iii) The final outcome in open globe injuries depends on the type of injury. Missile injuries were particularly associated with poor prognosis.

iv) The relationship between the size of the wound and the final visual outcome in open globe injuries was similar to what was reported previously. Lacerations more than 10mm in length had led to a much higher rate of enucleation and poor visual outcome.

v) Child's age at the time of injury also was a strong predictive factor. Children aged < 4 years had worst outcome. This could be attributed to amblyopia because a clear image cannot be presented to the retina due to corneal scarring or non compliance with glasses or aphakic contact lenses.

vi)The presence of an intraocular foreign body did not affect the final visual acuity[7].

Developing countries

A similar hospital based study was done in Taiwan in 156 children. The study showed that the preponderance of injuries in boys over girls was 2.1:1. Their study showed that the most common place of pediatric eye injuries is home (15.4%) followed by street (9.0%), school (7.7%) and sports venues (5.8%). The objects responsible for ocular injury were: unspecified sharp object(16.7%), scissors(13.5%), pencils/pens(12.2%), broken spectacles (7.7%), knife(6.4%), animal claws(5.8%), metal nails(2.6%), fingernails(1.3%). Their study also showed that the predictors of worst outcome were open globe injuries with large wound size, posterior segment involvement and the presence of an intraocular foreign body[1].

A retrospective study was done in Nepal by review of records of 6,829 children. 554 children had ocular injuries. The ocular injuries were more common in age group 5 -10 years. Ocular trauma was more common in boys (62%) than girls (38%) . Of the 554 children 32(5.8%) had open globe injuries. Home was the most common place for occurrence of trauma, n= 204(36.8%).[21]

INDIA

A retrospective study was done to review perforating ocular injuries in children in Ludhiana, Punjab from January 1981 to April 1990. 80 children below the age of 15 years were included in the study. The study showed that male children were more susceptible to ocular injury as compared to female children (p=<0.01).This finding was consistent with findings of most other studies. Majority of injuries were in the sports field (p=<0.01). Playing with bow and arrow and gilli danda accounted for majority (47.2%) of sports injuries (these sports are unique to our country). The domestic injury was caused mostly

by glass and knife (16.9%). Fire crackers used during festivals was the cause for 15.7% of injuries[2].

A study on ocular injuries in children was done at a tertiary care center at Bombay for a duration of one year. 44 children had reported with ocular injuries. Open globe injuries were noted in 28 cases. The incidence of ocular trauma was more common in males than females(5:1).Sticks were the most common object causing injury. Fire cracker injuries showed seasonal peak during Diwali. Majority of the patients (84.09%) received medical treatment in 6 hours, however 16% patients received medical treatment after 48 hours thus accelerating the complication rate.[23]

METHODOLOGY

This study was conducted in the Department of Ophthalmology, Christian Medical College & Hospital, Vellore.

TYPE OF STUDY

Observational study including retrospective chart analysis for 4 years and prospective study for 6 months.

INCLUSION CRITERIA [FOR PROSPECTIVE AND RETROSPECTIVE STUDY]

All children, at or below 18 years age, with open globe injury to one or both eyes

EXCLUSION CRITERIA

1. Children with open globe injury, who underwent surgery elsewhere.

2. Those who refused surgery in our hospital.

METHOD

THE HISTORIC ARM AND THE CONCURRENT ARM

All patients who presented to our emergency services were issued charts after registration. The demographic information was collected by the staff issuing the chart. This included- Name, Hospital number, age, sex, village, taluk and district

The details regarding the date, time, place, mode of injury and treatment sought from elsewhere before coming to our hospital were entered by the examining doctor.

Vision was examined in verbal children with Snellen's chart .In preverbal children visual assessment was done by checking response to light .

Systematic examination of the anterior and posterior segment was done and details were noted.

The details of ocular examination included

1. Corneal tear- whether pupillary axis was involved or not, length of the tear
2. Anterior segment-presence of hypopyon, hyphema, iris prolapse, irododialysis
3. Sclera l tear- < 5 mm from limbus,> 5 mm from limbus
4. Lens- Cataract present with anterior or posterior capsular rupture
5. Posterior segment- presence of vitreous haemorrhage, vitreous cells or vitreous loss
6. Intraocular foreign body – present or not present
7. Retina- detachment is present or not.

   Details of imaging and presence or absence of intraocular foreign body were noted.

Surgery was conducted as soon as possible. The details of surgery, whether vitreous tap was taken or not, intravitreal antibiotics were given or not were taken from the medical records of the patient.

On follow up details of vision, , refraction, complications were noted.

Vision was classified into 5 groups :

- 6/6 $\geq$ 6/12
- 6/18-6/36
- 6/60 to 4/60
- 3/60 to 2/60
- 1/60 to PL
- No Perception of light
- Un -cooperative

Post operative follow up details at first week, 1 month and 6 months post trauma were considered for our study.

Details regarding secondary surgical procedures which the child underwent were also noted.

Special focus was made on whether refractive error was corrected promptly and whether amblyopia treatment was given.

The clinical research forms were rechecked to ensure completion of data entry and validity.

Historic arm

The data was collected from medical records of children with open globe injuries who had presented to the emergency services from August 2007 to July 2011.

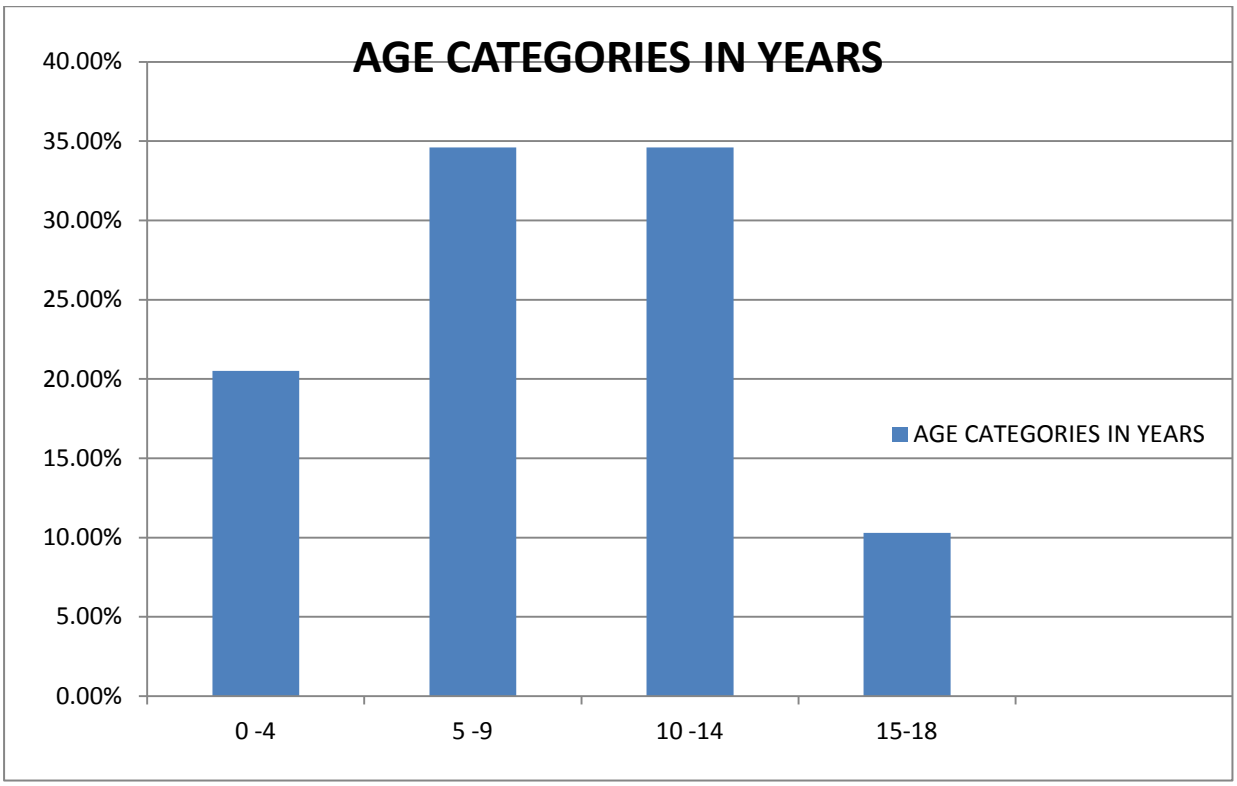
Concurrent arm

In the concurrent arm, all the children with open globe injuries presenting to the emergency services from August 2011 to January 2012 were included. The Clinical Research Form was filled after obtaining consent from the guardian and assent from the child.

The routine statistics, including proportions, means and chi-square tests were carried out with SPSS software. Odds-ratio and 95% confidence intervals were computed to evaluate the strength of association between the various factors.

DATA ANALYSIS AND RESULTS

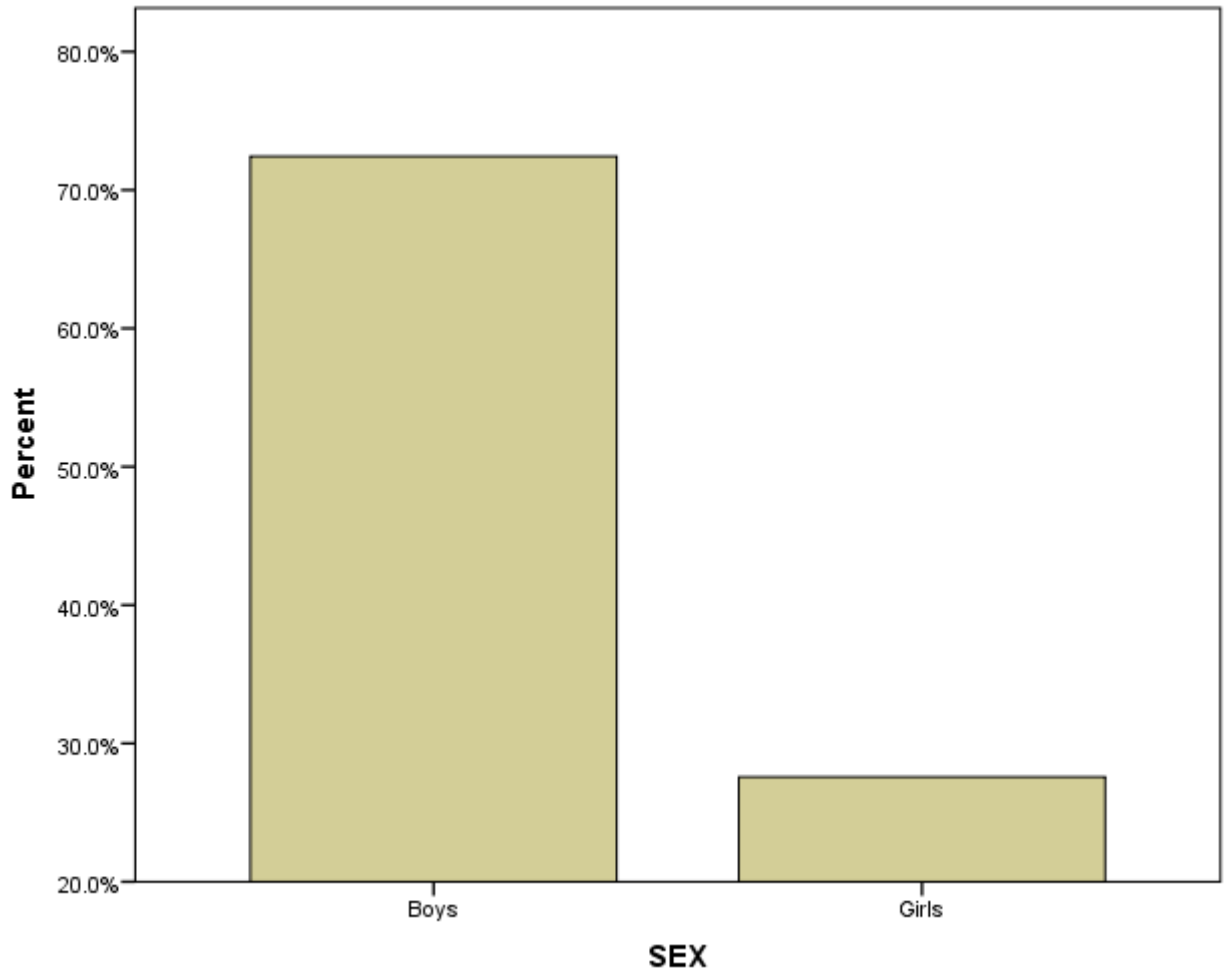
FREQUENCY OF OPEN GLOBE INJURIES IN VARIOUS AGE GROUPS



AGE IN YEARS	FREQUENCY	PERCENTAGE
0-4	32	20.5%
5-9	54	34.6%
10-14	54	34.6%
15-18	16	10.3%

OVERALL MEAN AGE: 8.66 YEARS

FREQUENCY OF OPEN GLOBE INJURIES AMONG BOYS AND GIRLS

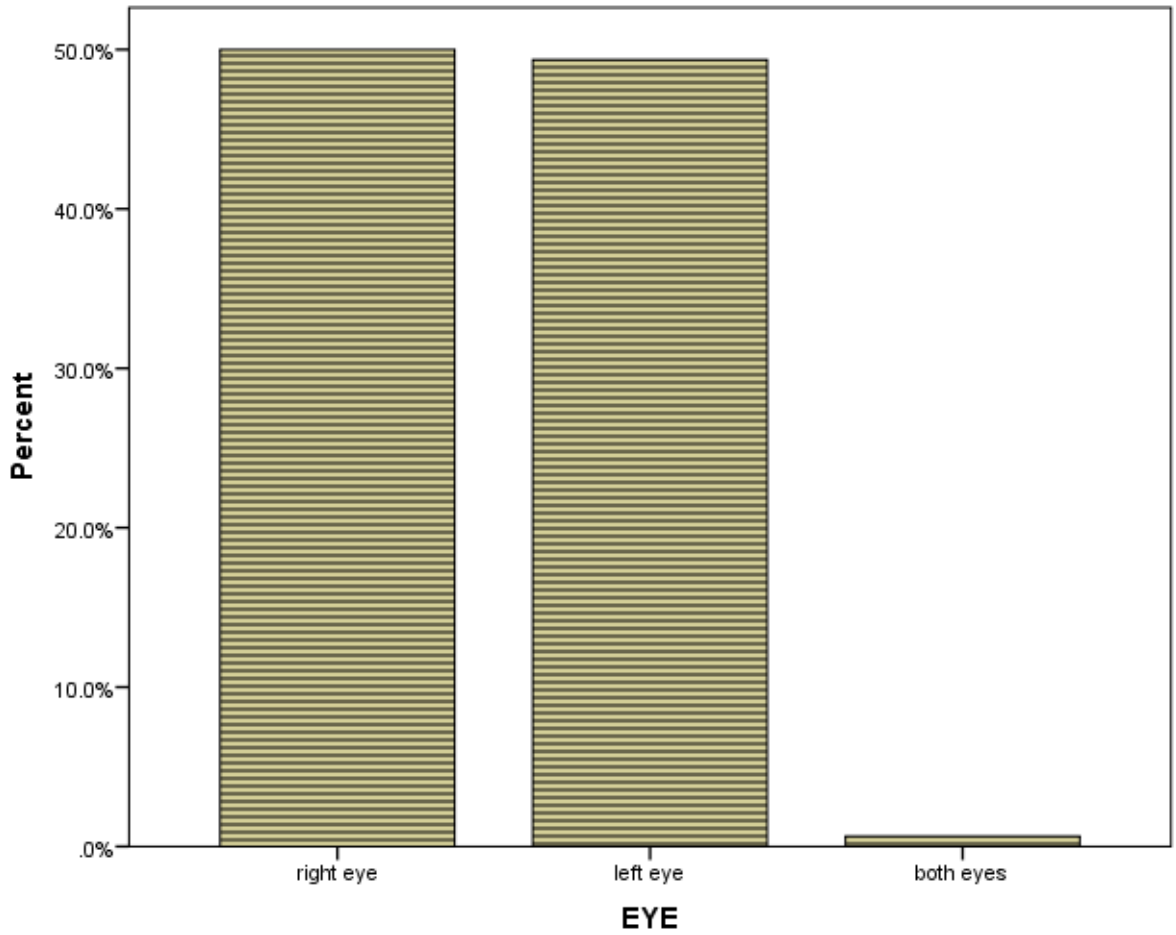


	FREQUENCY	PERCENTAGE
BOYS	113	72.4
GIRLS	43	27.6

MEAN AGE AMONG BOYS: 9.04 YEARS

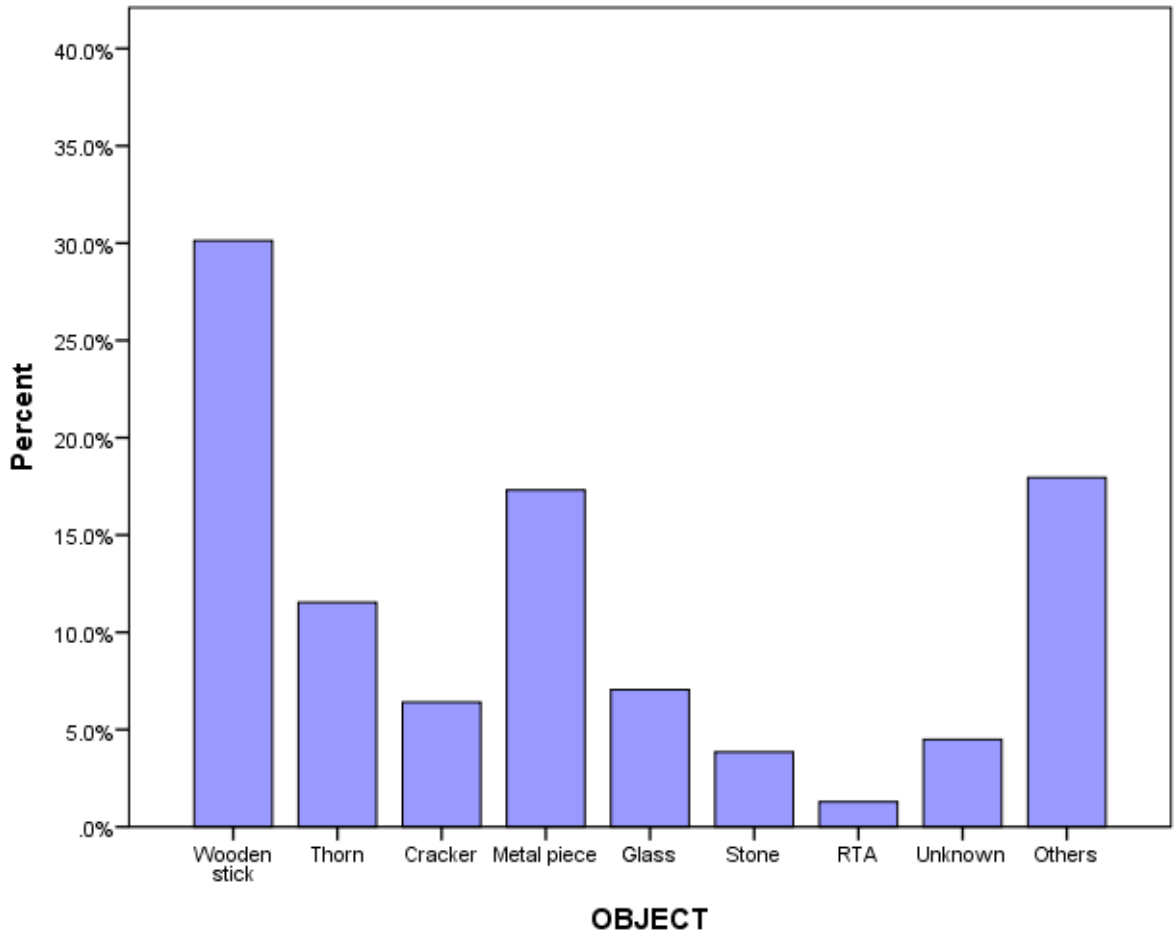
MEAN AGE AMONG GIRLS: 7.66 YEARS

LATERALITY



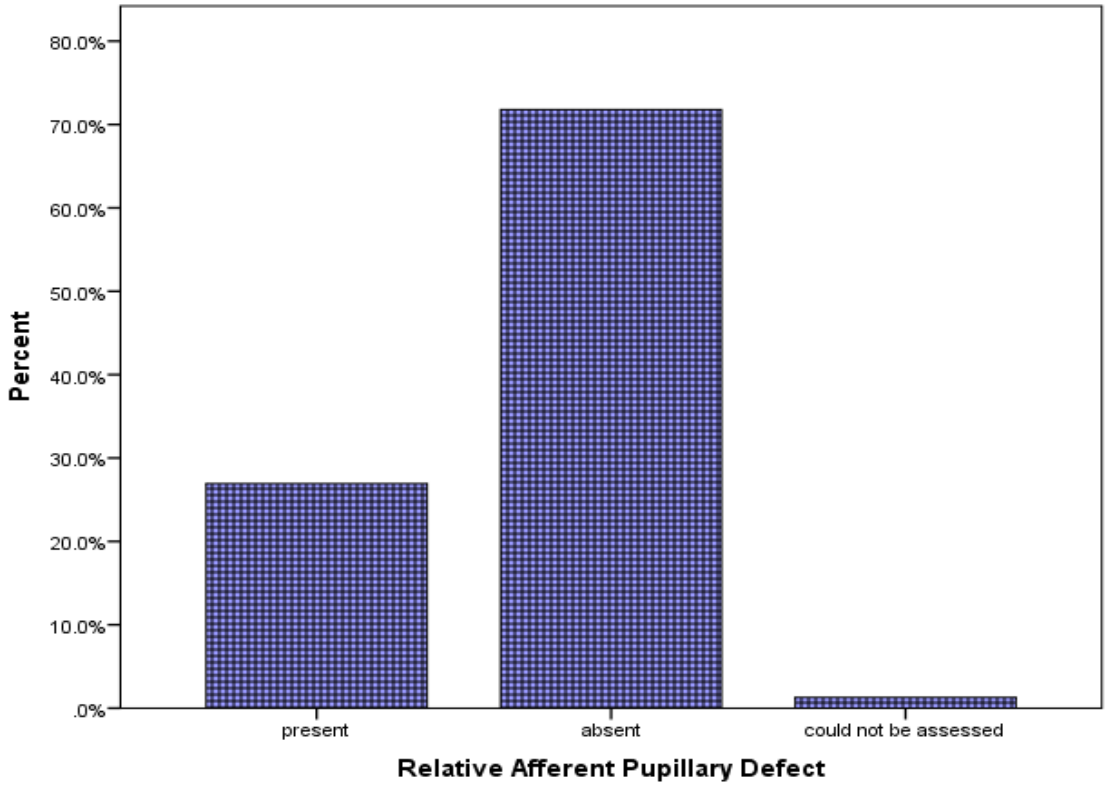
	FREQUENCY	PERCENTAGE
RIGHT EYE	78	50.0
LEFT EYE	77	49.4
BOTH EYES	1	0.6

OBJECT CAUSING INJURY



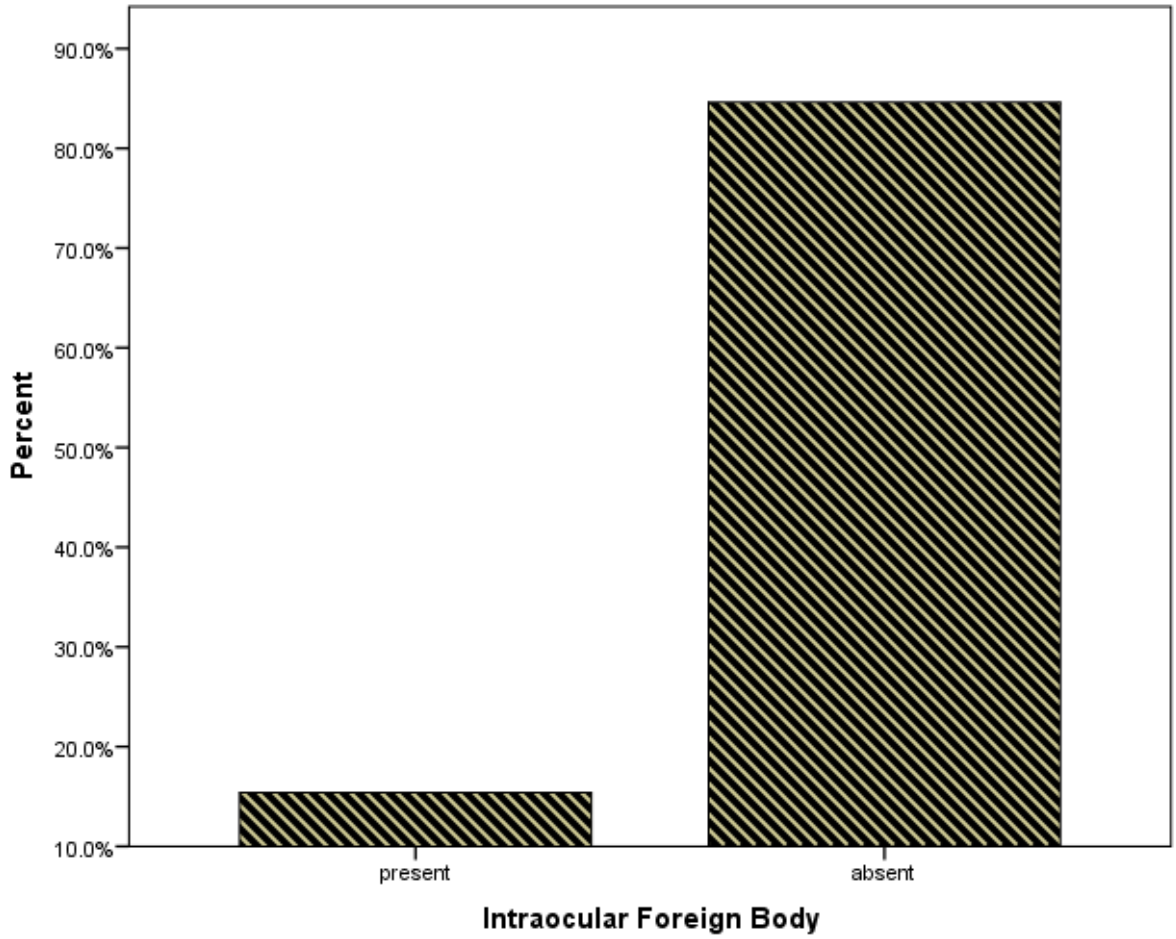
OBJECT	FREQUENCY	PERCENTAGE
WOODEN STICK	47	30.1
THORN	18	11.5
FIRE CRACKER	10	6.4
METAL PIECE	27	17.3
GLASS	11	7.1
STONE	6	3.8
RTA	2	1.3
UNKNOWN	7	4.5
OTHERS	28	17.9

RELATIVE AFFERENT PUPILLARY DEFECT



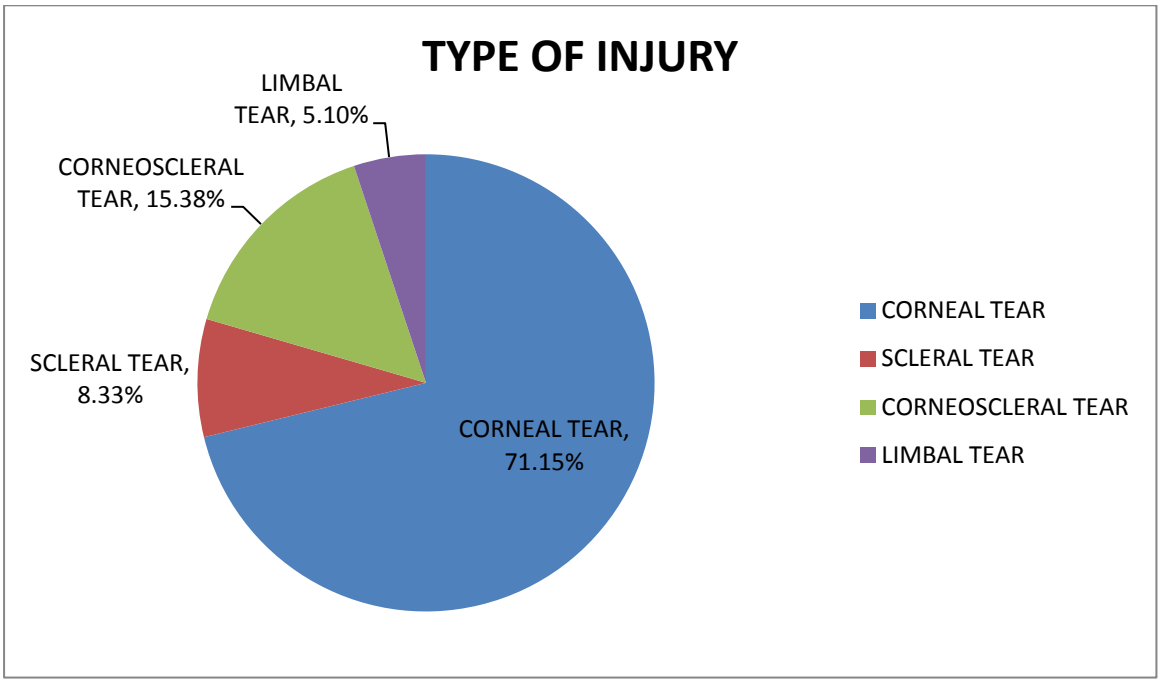
	FREQUENCY	PERCENTAGE
RAPD PRESENT	42	26.9
RAPD ABSENT	112	71.8
RAPD COULD NOT BE ASSESSED	2	1.3

INTRAOCULAR FOREIGN BODY



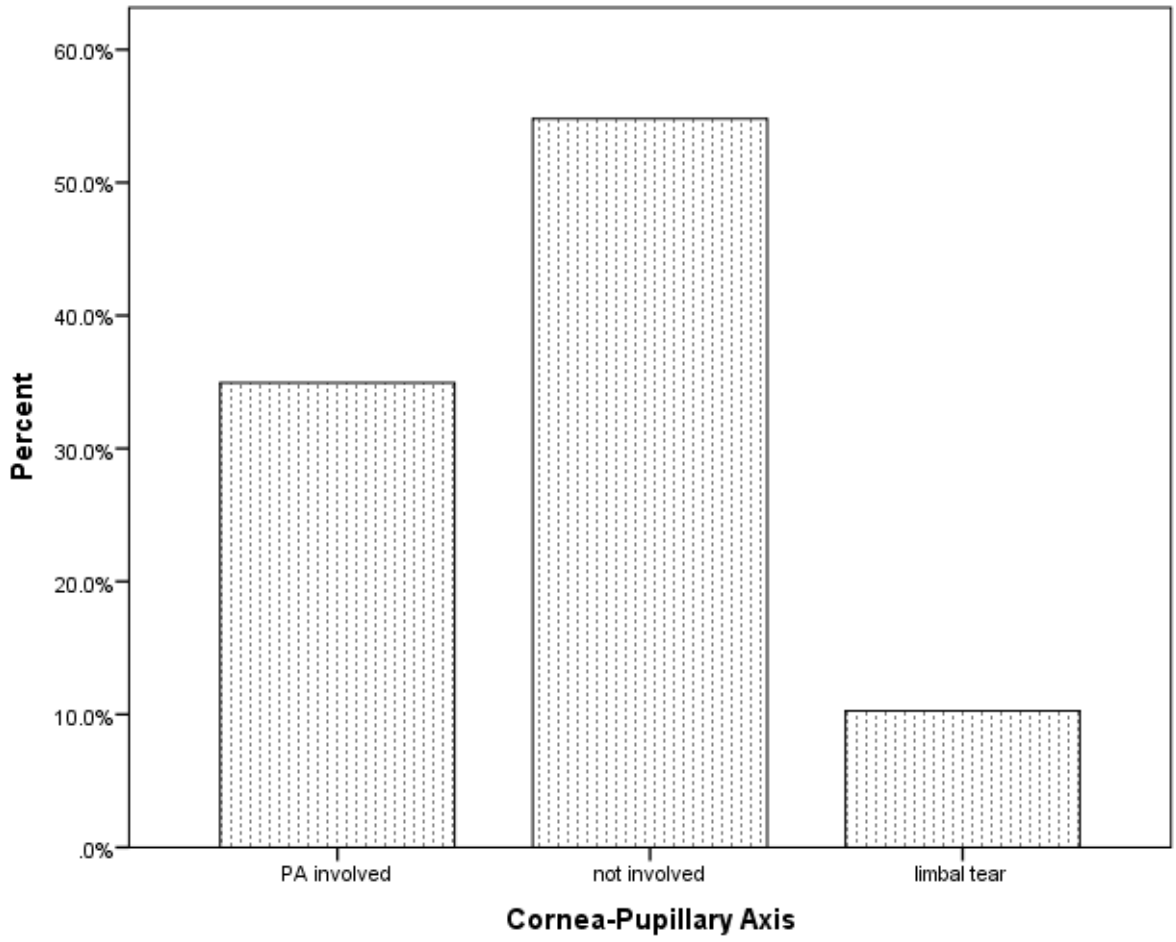
	FREQUENCY	PERCENTAGE
IOFB PRESENT	24	15.4
IOFB ABSENT	132	84.6

TYPE OF INJURY



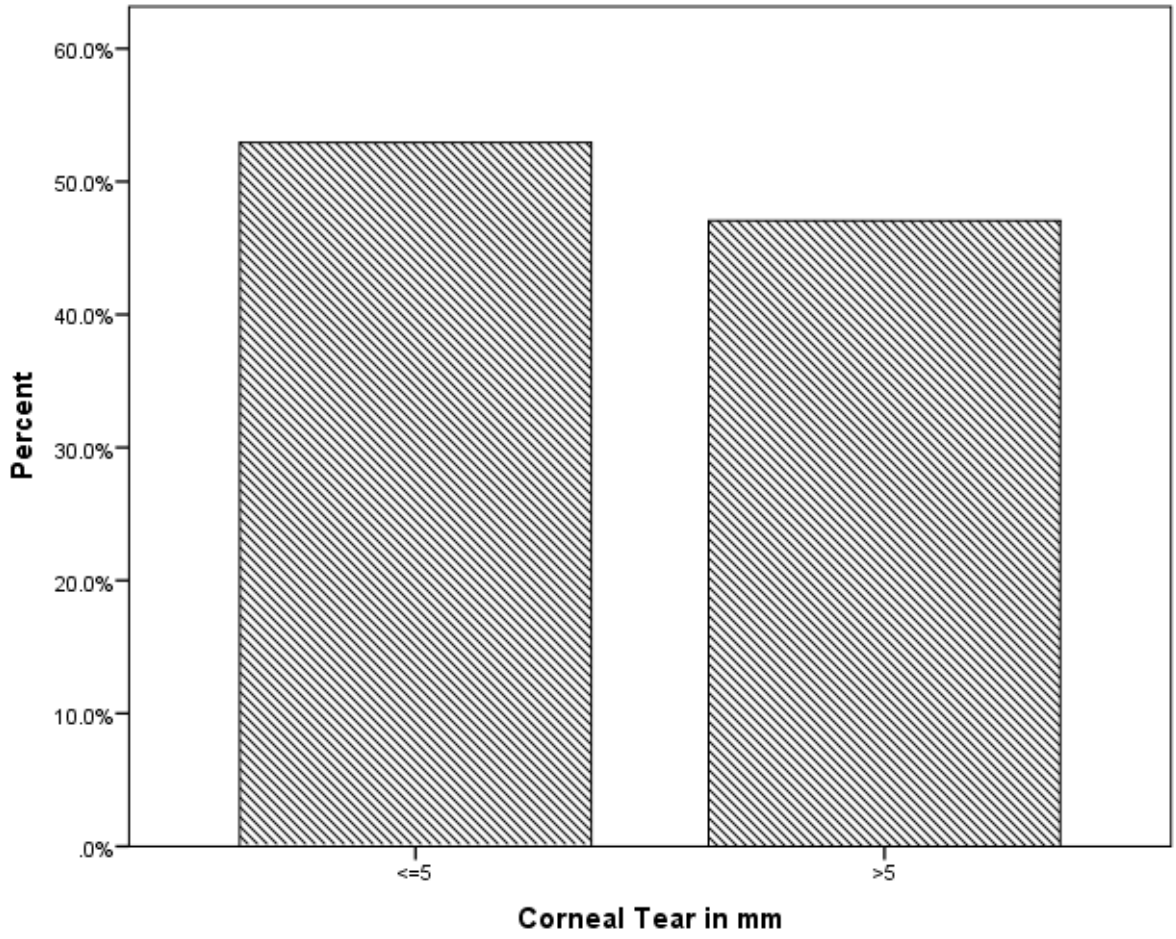
	FREQUENCY	PERCENTAGE
CORNEAL TEAR	111	71.15
SCLERA L TEAR	13	8.33
CORNEOSCLERAL TEAR	24	15.38
LIMBAL TEAR	8	5.1

CORNEAL TEAR



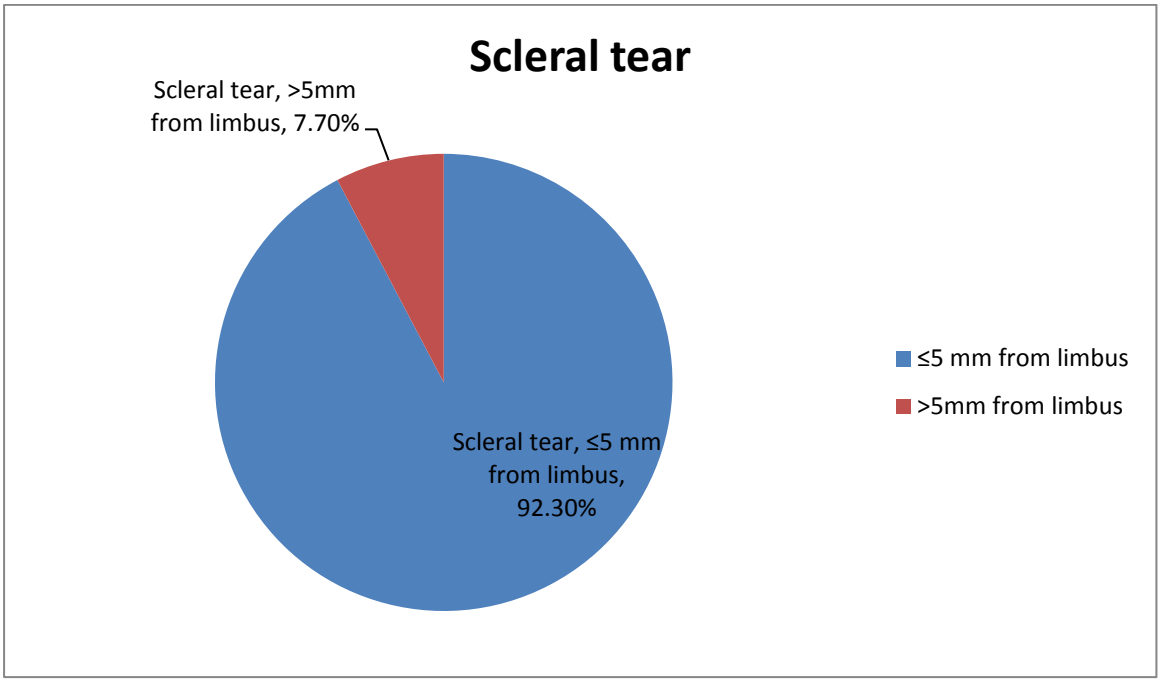
	FREQUENCY	PERCENTAGE
PUPILLARY AXIS INVOLVED	51	34.9
PUPILLARY AXIS NOT INVOLVED	80	54.8
LIMBAL TEAR	15	10.3

SIZE OF CORNEAL TEAR



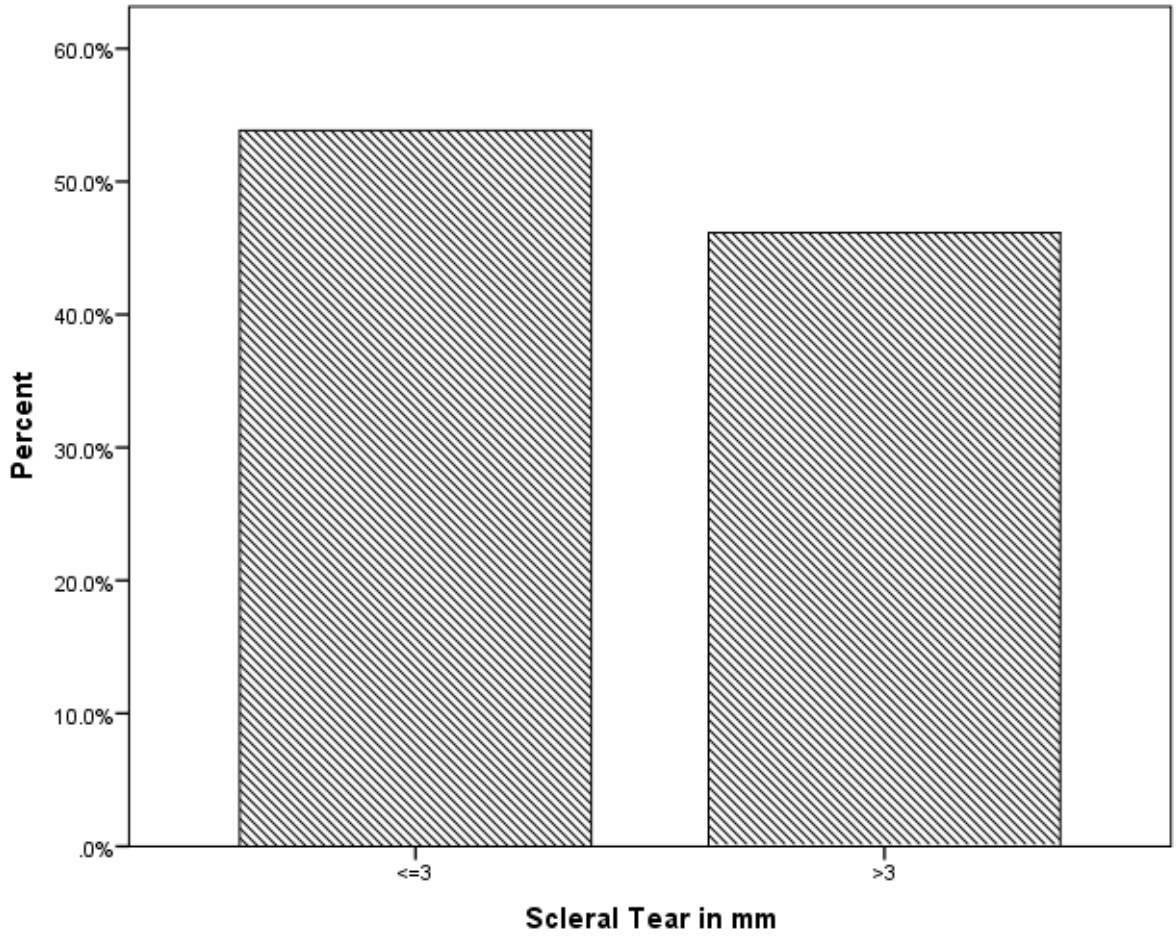
CORNEAL TEAR	FREQUENCY	PERCENTAGE
≤5mm	63	52.9
>5mm	56	47.1

SCLERAL TEAR



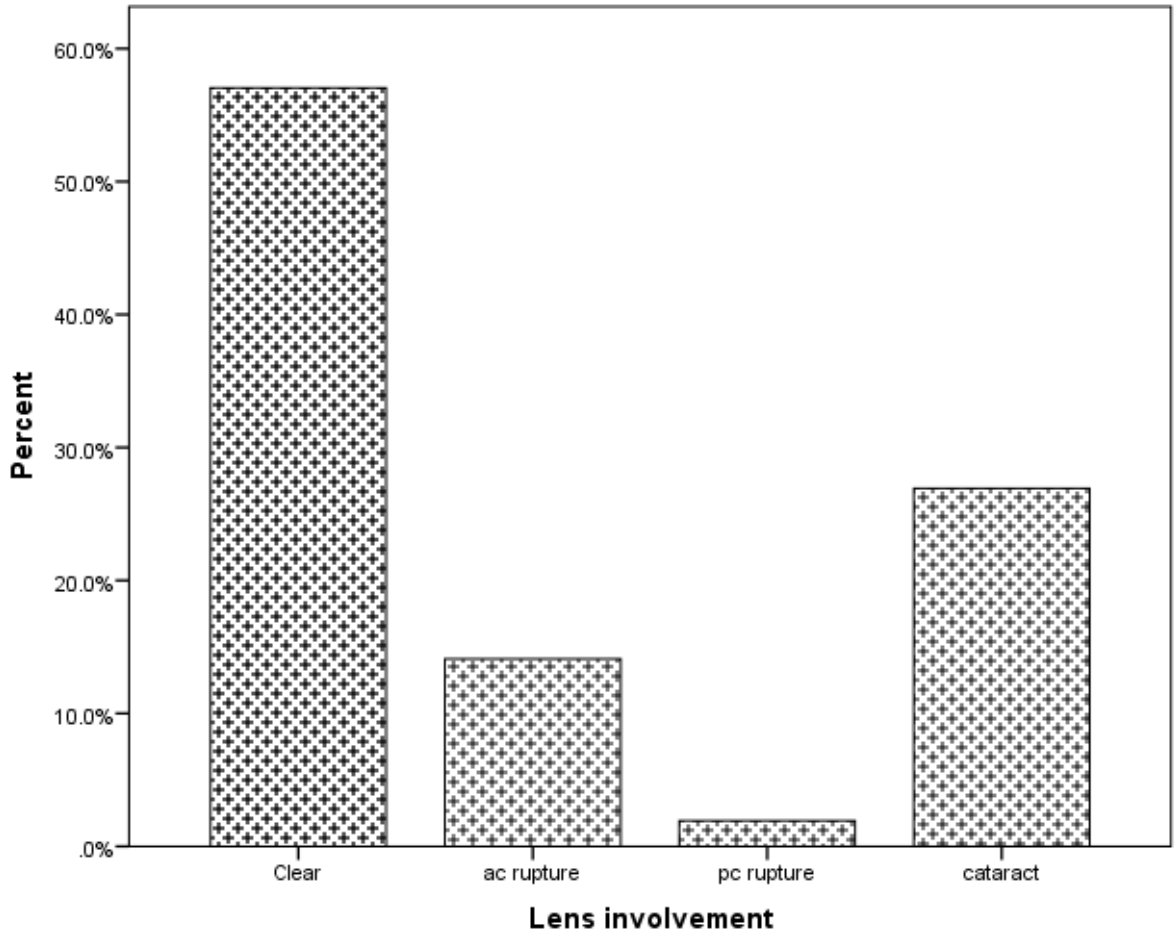
	FREQUENCY	PERCENTAGE
≤ 5MM FROM LIMBUS	24	92.3
>5MM FROM LIMBUS	2	7.7

SIZE OF SCLERAL TEAR



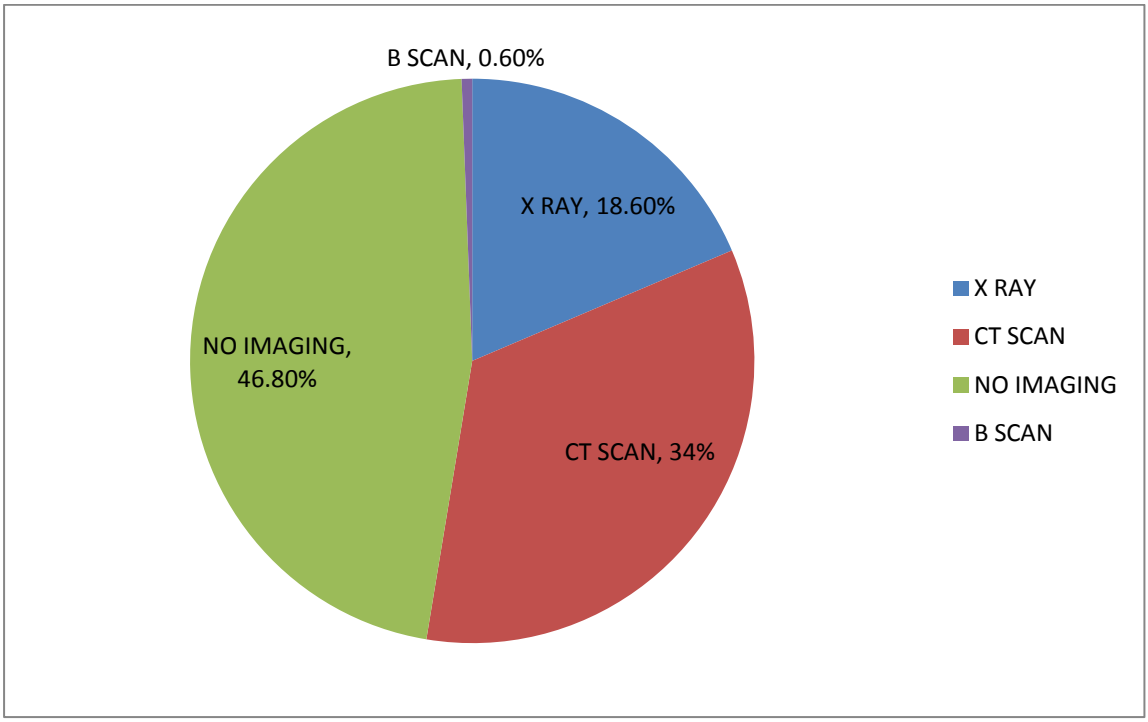
SCLERAL TEAR	FREQUENCY	PERCENTAGE
≤3mm	14	53.8
>3mm	12	46.2

LENS INVOLVEMENT



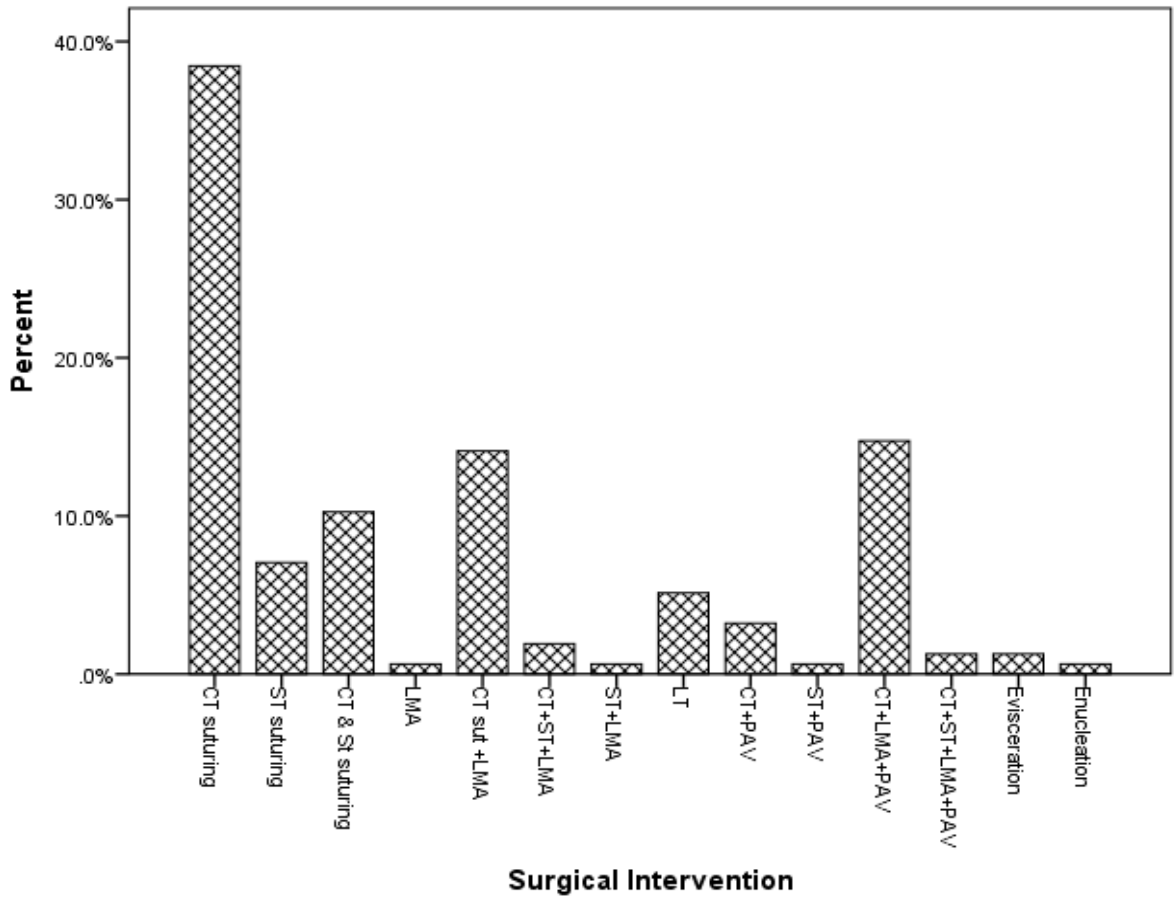
	FREQUENCY	PERCENTAGE
CLEAR LENS	89	57.1
AC RUPTURE	22	14.1
AC & PC RUPTURE	3	1.9
CATARACT	42	26.9

IMAGING



	FREQUENCY	PERCENTAGE
X RAY	29	18.6
CT SCAN	53	34.0
NO IMAGING	73	46.8
B SCAN	1	0.6

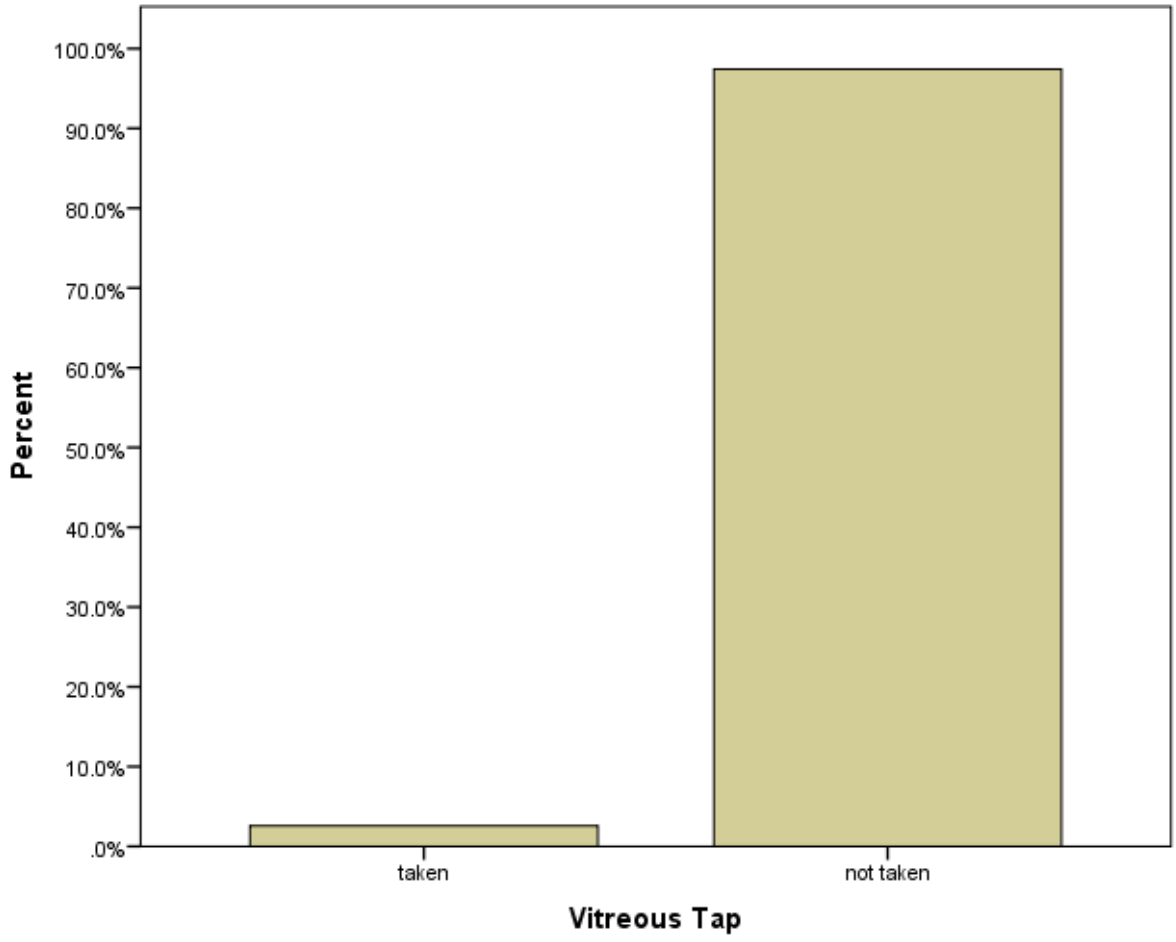
PRIMARY SURGICAL INTERVENTION DONE



	FREQUENCY	PERCENTAGE
CT SUTURING	60	38.5
ST SUTURING	11	7.1
CT & ST SUTURING	16	10.3
LMA	1	6
CT SUTURING +LMA	22	14.1

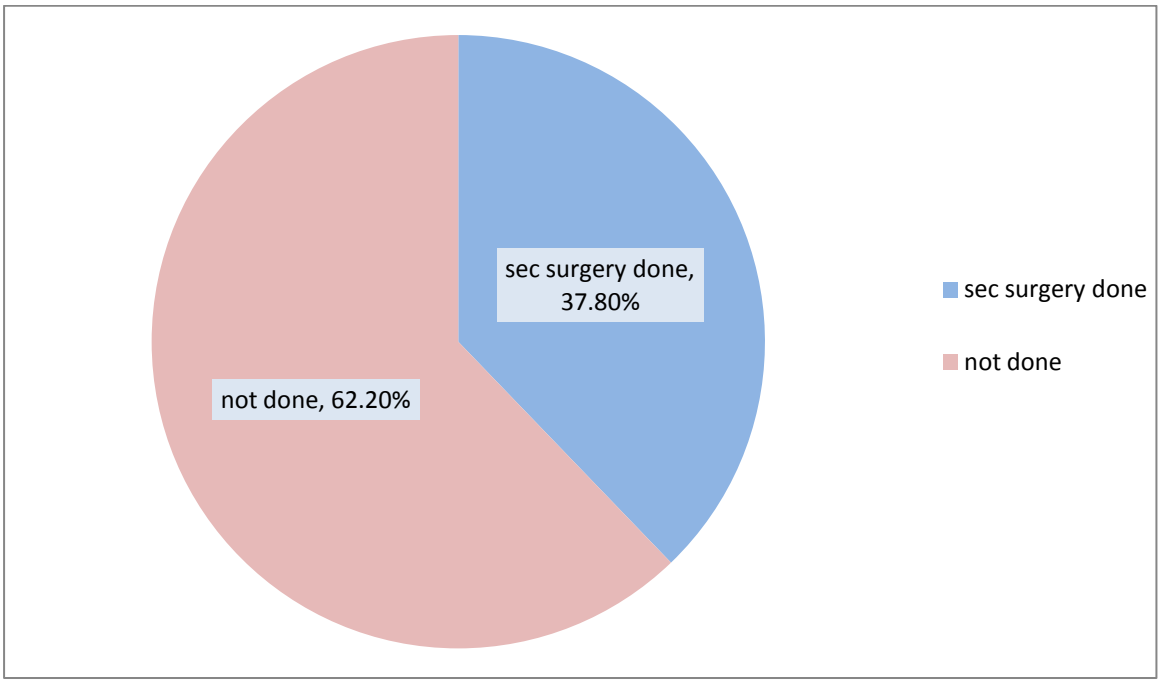
CT&ST SUT+LMA	3	1.9
ST SUT+ LMA	1	0.6
LIMBAL TEAR SUTURING	8	5.1
CT SUT+ PAV	5	3.2
ST SUT+ PAV	1	0.6
CT SUT+ LAM+PAV	23	14.7
CT+ST SUT+LMA+PAV	2	1.3
EVISCERATION	2	1.3
ENUCLEATION	1	0.6

VITREOUS TAP



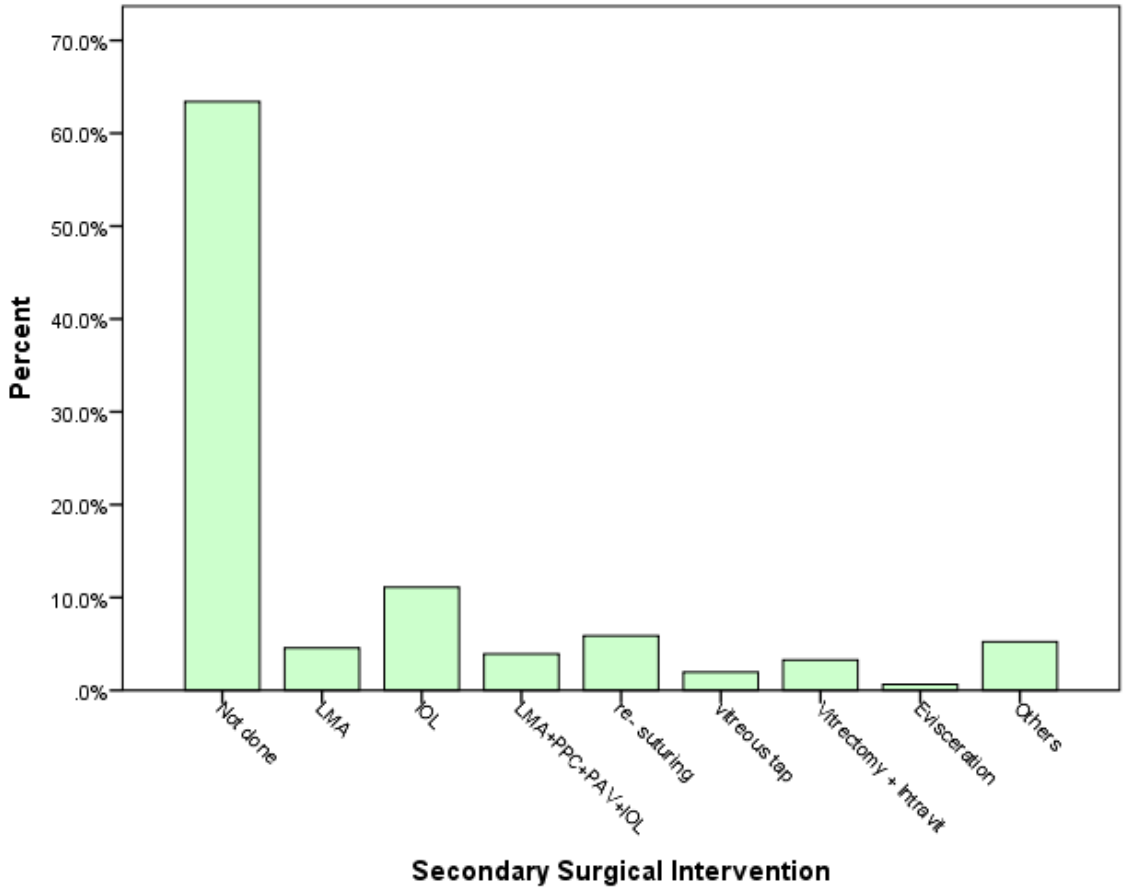
	FREQUENCY	PERCENTAGE
VITREOUS TAP TAKEN	4	2.6
NOT TAKEN	152	97.4

SECONDARY SURGICAL INTERVENTION



SECONDARY SURGERY	FREQUENCY	PERCENTAGE
DONE	59	37.8%
NOT DONE	97	62.2%

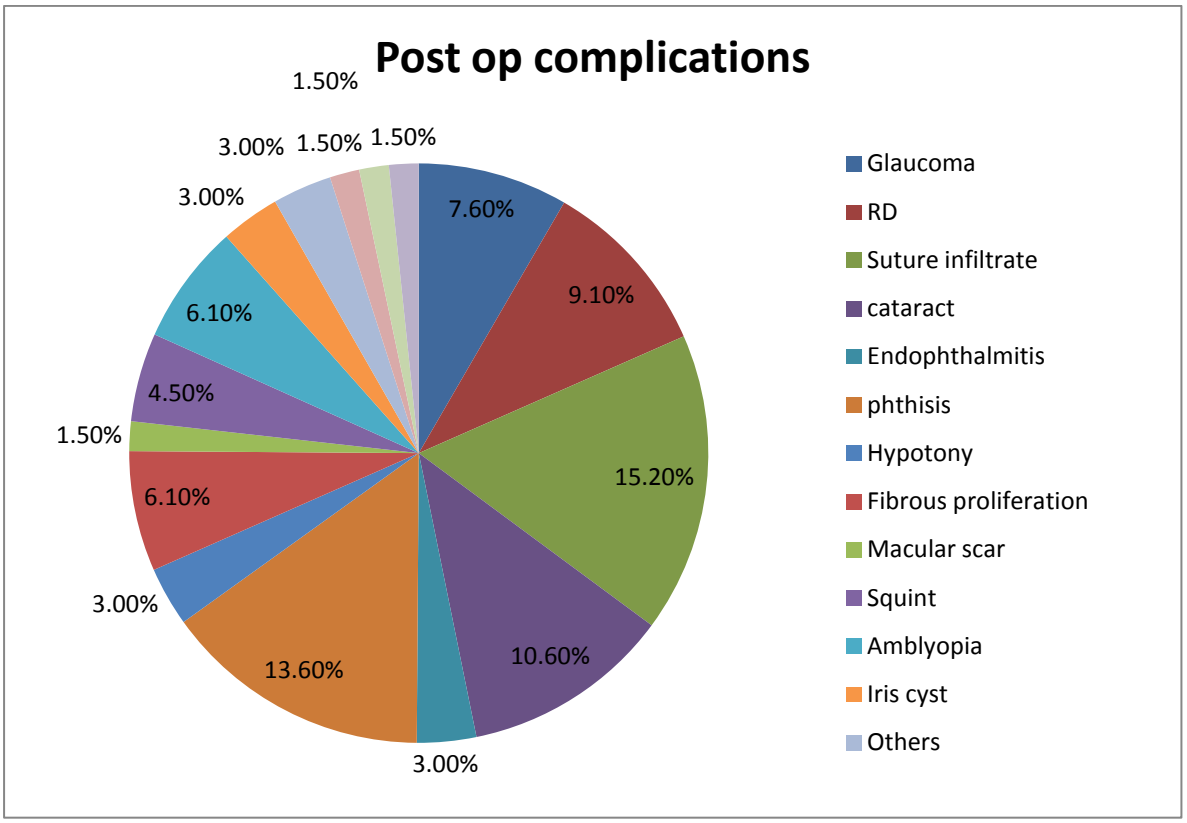
TYPES OF SECONDARY SURGICAL INTERVENTIONS DONE



SEC SURGERY	FREQUENCY	PERCENTAGE
NO INTERVENTION	97	63.4
LMA	7	4.6

IOL	17	11.1
LMA+PPC+PAV+IOL	6	3.9
RESUTURING	9	5.9
VITREOUS TAP	3	2.0
VITRECTOMY+INTRA VITREAL ANTIBIOTIC	5	3.3
EVISCERATION	1	0.7
OTHERS	8	5.2

POST OP COMPLICATIONS



	FREQUENCY	PERCENTAGE
GLAUCOMA	5	7.6
RD	6	9.1
SUTURE INFILTRATE	10	15.2

CATARACT	7	10.6
ENDOPHTHALMITIS	2	3.0
PHTHISIS	9	13.6
HYPOTONY	2	3.0
FIBROUS PROLIFERATION	4	6.1
MACULA SCAR	1	1.5
SQUINT	3	4.5
AMBLYOPIA	4	6.1
IRIS CYST	2	3.0
OTHERS	2	3.0
ENDOPHTHAL-MITIS +PHTHISIS	1	1.5
CATARACT+ MACULAR SCAR	1	1.5
HIGH IOP+ IRIS CYST	1	1.5
PVR+ CORNEAL ULCER	1	1.5
HYPOTONY+ PHTHISIS	1	1.5
SUTURE INFILTRATE+ RD	1	1.5
SQUINT+ RD	1	1.5
RD+ PHTHISIS	1	1.5

CATARACT+ HIGH IOP	1	1.5

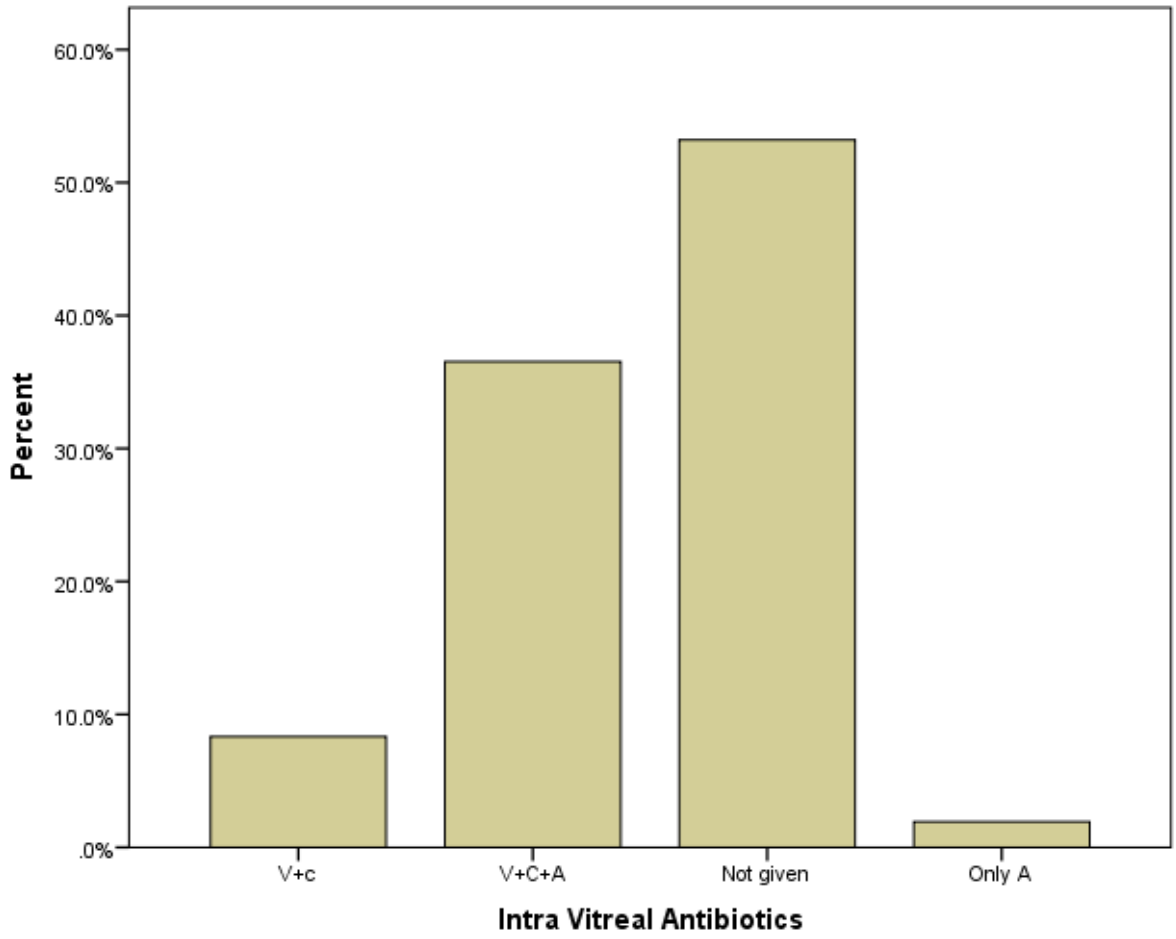
ASSOCIATION BETWEEN OBJECT CAUSING INJURY AND ENDOPHTHALMITIS

	Endophthalmitis				p value
	Present		Absent		
	n	%	n	%	
OBJECT CAUSING INJURY Vegetable matter	2	66.7%	26	41.3%	0.570
Others	1	33.3%	37	58.7%	

ASSOCIATION BETWEEN PRESENCE OF INTRAOCULAR FOREGIN BODY AND ENDOPHTHALMITIS

	Endophthalmitis				**p value**
	Present		**Absent**		
	n	**%**	**n**	**%**	
IOFB Present	0	0%	15	23.8%	1.000
Absent	3	100%	48	76.2%	

INTRAVITREAL ANTIBIOTICS



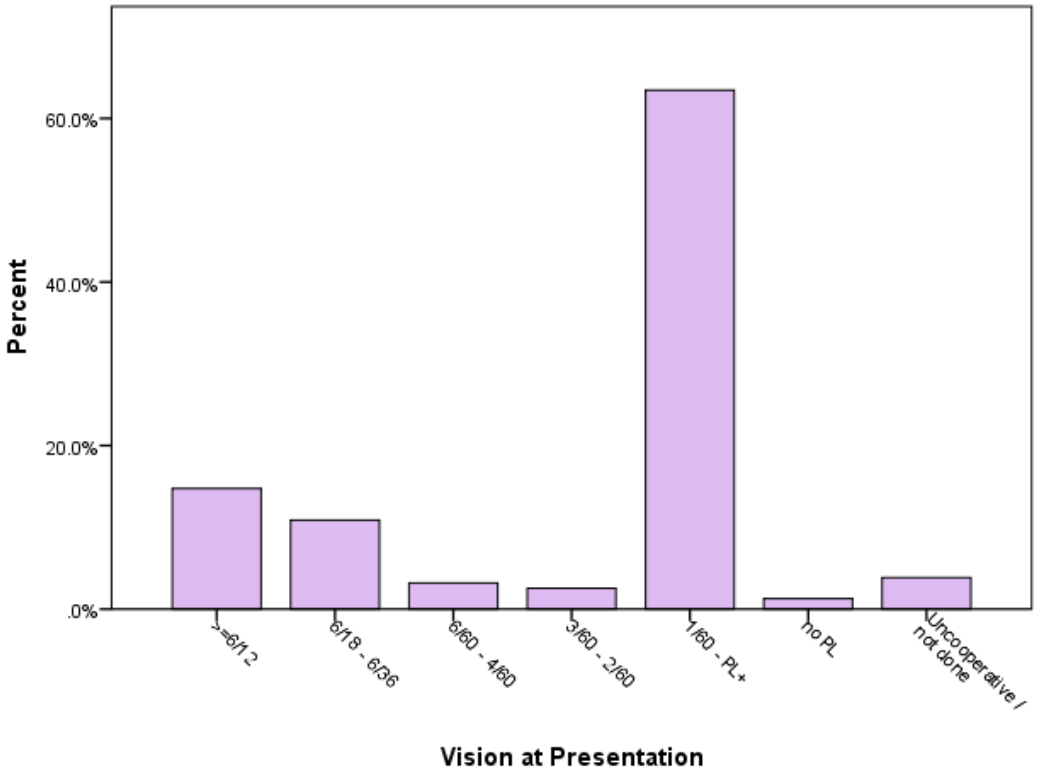
	FREQUENCY	PERCENTAGE
VANCOMYCIN+CEFTAZADIME	13	8.3
VANCOMYCIN+CEFTAZADIME+ AMPHOTERICIN	57	36.5
NOT GIVEN	83	53.2
AMPHOTERICIN	3	1.9

ASSOCIATION BETWEEN VITREOUS LOSS AND ENDOPHTHALMITIS

	ENDOPHTHALMITIS				p value
	Present		Absent		
	n	%	n	%	
VITREOUS LOSS present	0	0%	14	22.2%	1.000
Absent	3	100%	49	77.8%	

VISUAL PROGNOSTICS

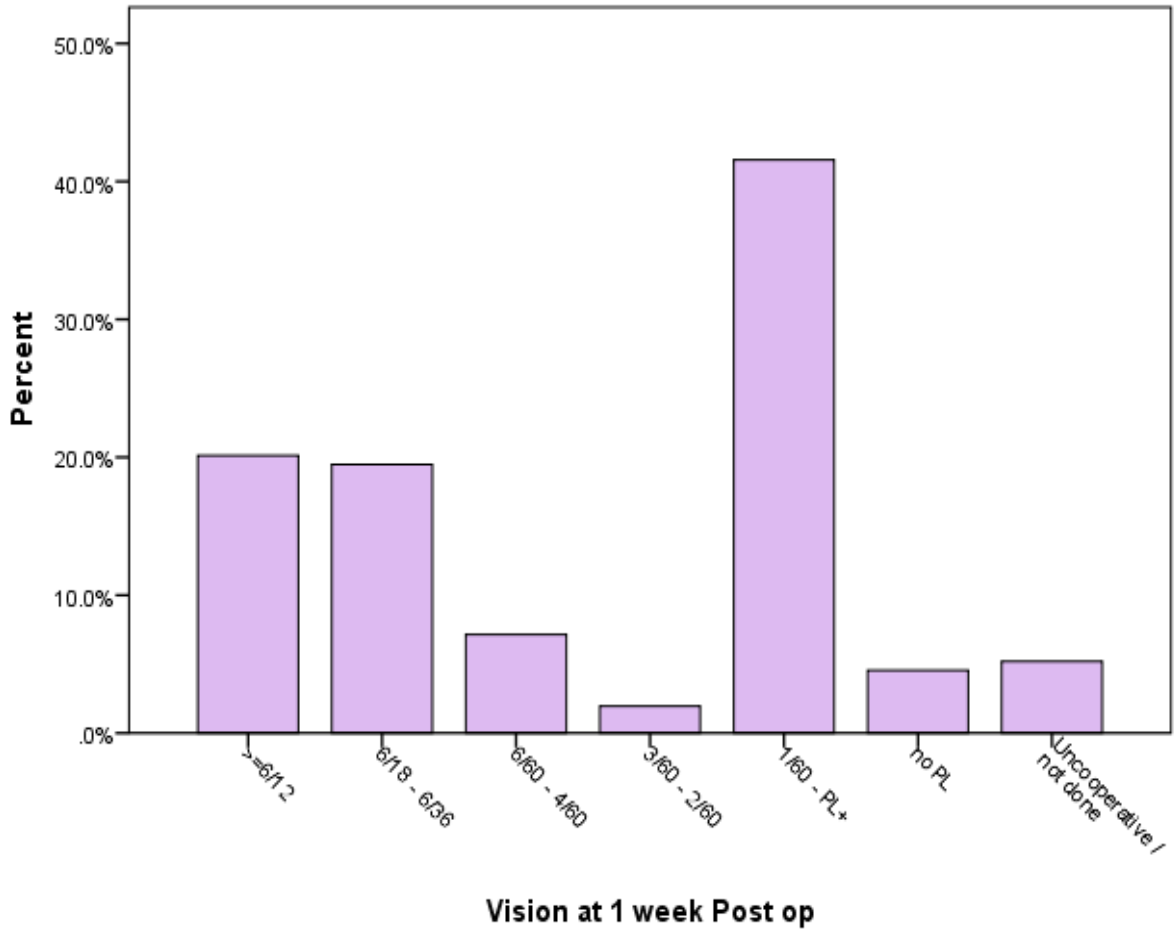
VISION AT PRESENTATION



AT PRESENTATION	FREQUENCY	PERCENTAGE
≥6/12	23	14.7
6/18-6/36	17	10.9
6/60-4/60	5	3.2
3/60-2/60	4	2.6

1/60-PL	99	63.5
NO PL	2	1.3
UNCOOPERATIVE/ NOT DONE	6	3.8

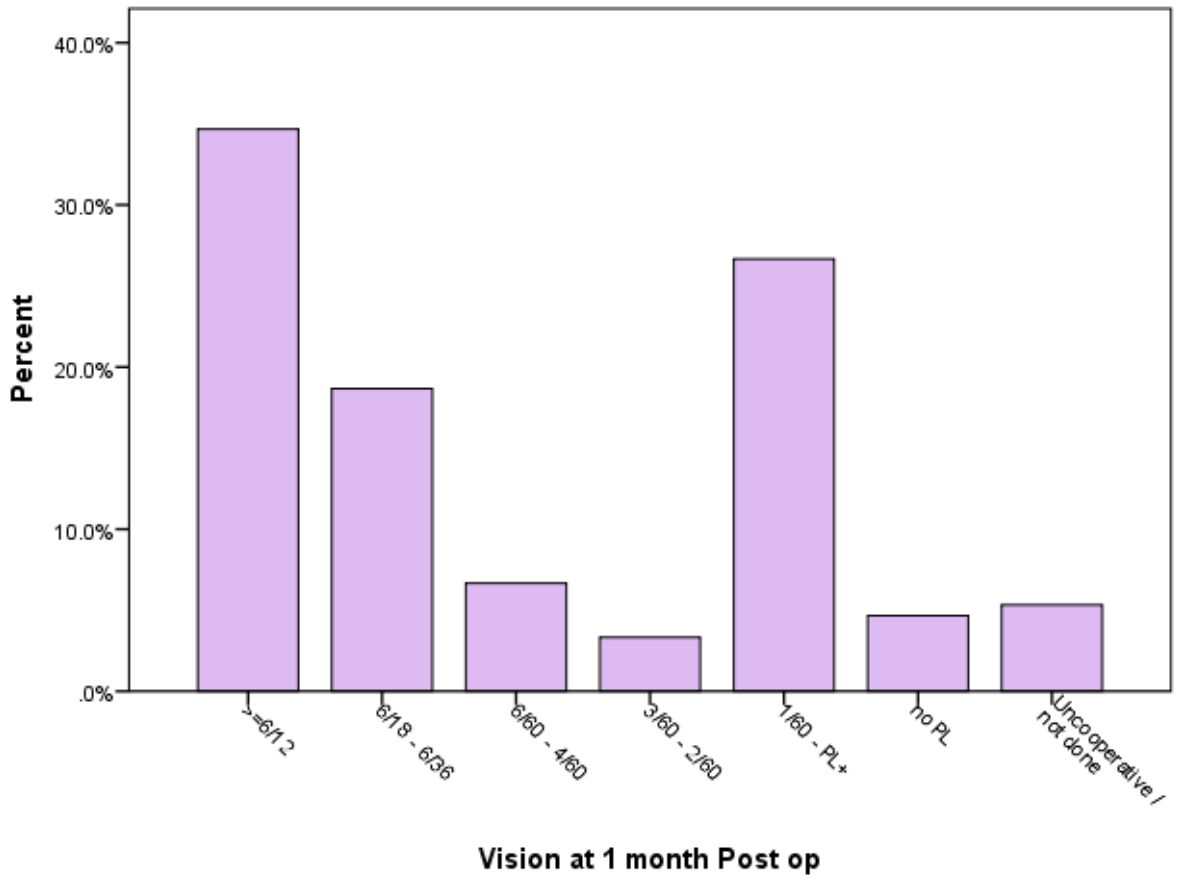
VISION AT 1 WEEK POST OP



1 WK POST OP	FREQUENCY	PERCENTAGE
≥6/12	31	20.1
6/18-6/36	30	19.5
6/60-4/60	11	7.1
3/60-2/60	3	1.9
1/60-PL	64	41.6
NO PL	7	4.5

UNCO-OPERATIVE/NOT DONE	8	5.2

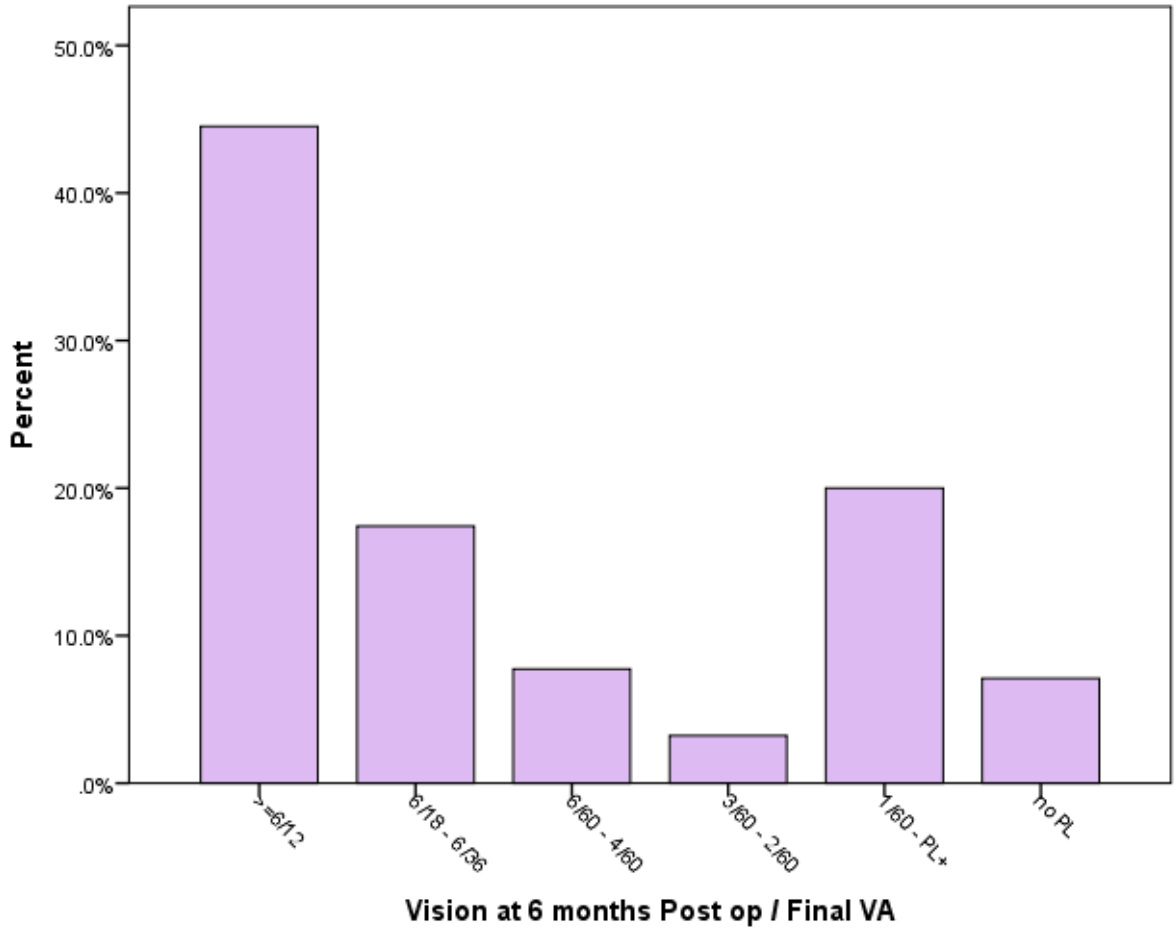
VISION AT 1 MONTH POST OP



1 MONTH POST OP	FREQUENCY	PERCENTAGE
≥6/12	52	34.7
6/18-6/36	28	18.7
6/60-4/60	10	6.7
3/60-2/60	5	3.3

1/60-PL	40	26.7
NO PL	7	4.7
UNCO-OPERATIVE/NOT DONE	8	5.3

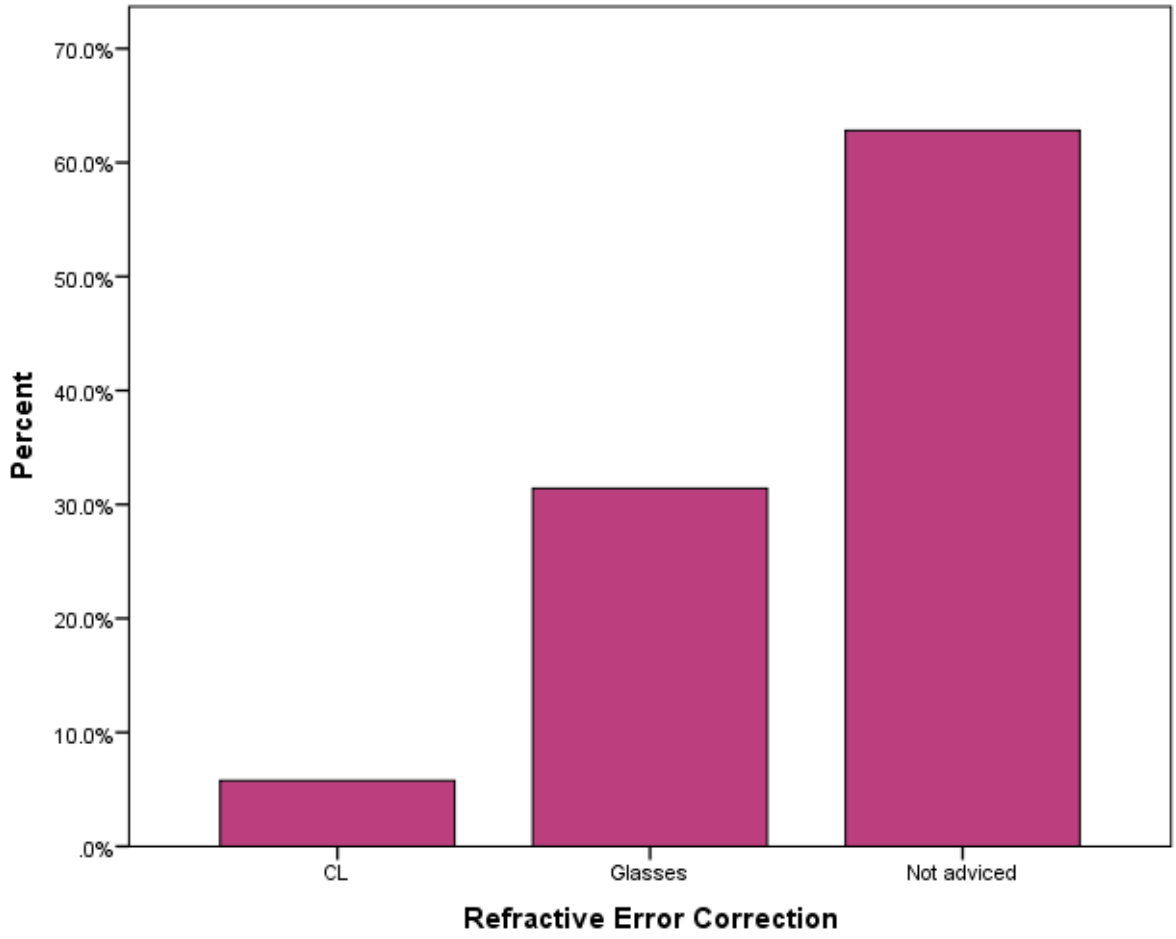
VISION AT 6 MONTHS POST OP



6 MONTHS POST OP	FREQUENCY	PERCENTAGE
≥6/12	69	44.5
6/18-6/36	27	17.4
6/60-4/60	12	7.7
3/60-2/60	5	3.2

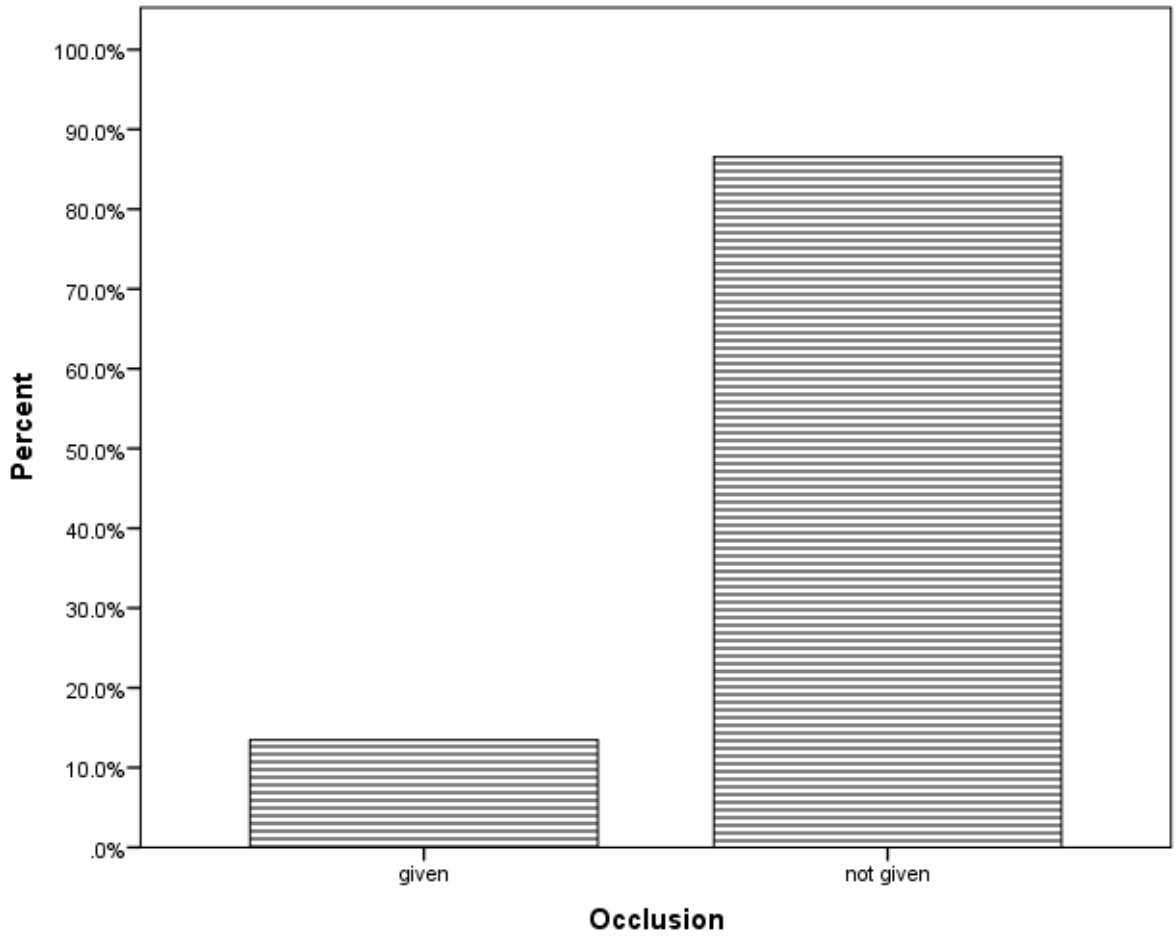
1/60-PL	31	20.0
NO PL	11	7.1

REFRACTIVE ERROR CORRECTION



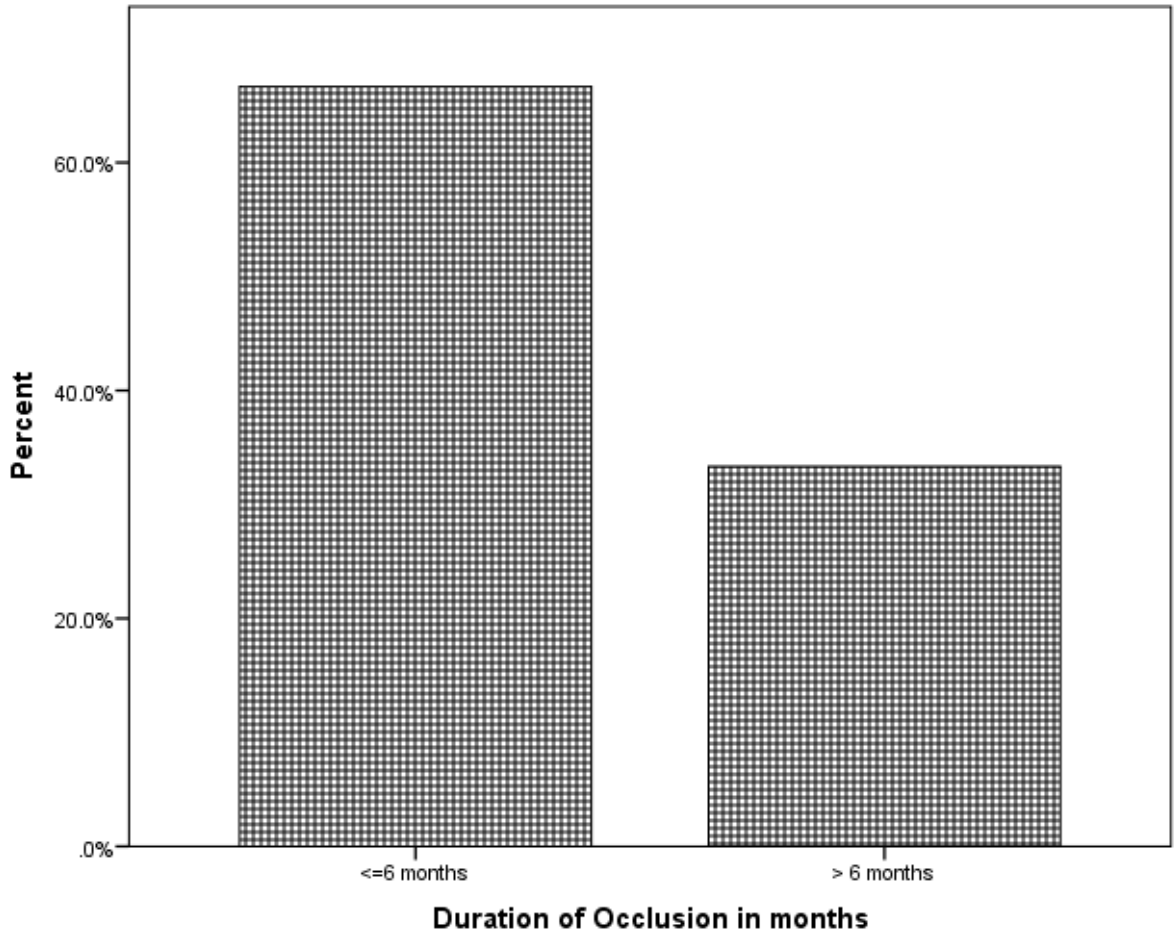
	FREQUENCY	PERCENTAGE
CONTACT LENSES	9	5.8
GLASSES	49	31.4
NONE	98	62.8

OCCLUSION THERAPY



	FREQUENCY	PERCENTAGE
OCCLUSION GIVEN	21	13.5
OCCLUSION NOT GIVEN	135	86.5

DURATION OF OCCLUSION THERAPY



	FREQUENCY	PERCENTAGE
≤6 MONTHS	14	66.7
>6 MONTHS	7	33.3

ASSOCIATION BETWEEN RELATIVE AFFERENT PUPILLARY DEFECT AND POOR VISION & BLINDNESS

	ENDOPHTHALMITIS				p value
	Present		Absent		
	n	%	n	%	
VITREOUS LOSS present	0	0%	14	22.2%	1.000
Absent	3	100%	49	77.8%	

ASSOCIATION BETWEEN OBJECT CAUSING INJURY AND ENDOPHTHALMITIS

	Endophthalmitis				p value
	Present		Absent		
	n	%	n	%	
OBJECT CAUSING INJURY Vegetable matter	2	66.7%	26	41.3%	0.570
Others	1	33.3%	37	58.7%	

ASSOCIATION BETWEEN PRESENCE OF INTRAOCULAR FOREGIN BODY AND ENDOPHTHALMITIS

	Endophthalmitis				**p value**
	Present		**Absent**		
	n	**%**	**n**	**%**	
IOFB Present	0	0%	15	23.8%	1.000
Absent	3	100%	48	76.2%	

ASSOCIATION BETWEEN VITREOUS LOSS AND ENDOPHTHALMITIS

	ENDOPHTHALMITIS				p value
	Present		Absent		
	n	%	n	%	
VITREOUS LOSS present	0	0%	14	22.2%	1.000
Absent	3	100%	49	77.8%	

ASSOCIATION BETWEEN RELATIVE AFFERENT PUPILLARY DEFECT AND POOR VISION & BLINDNESS

	ENDOPHTHALMITIS				p value
	Present		Absent		
	n	%	n	%	
VITREOUS LOSS present	0	0%	14	22.2%	1.000
Absent	3	100%	49	77.8%	

ASSOCIATION BETWEEN ENDOPHTHALMITIS AND POOR VISION & BLINDNESS

	POOR VISION		BLINDNESS		OTHERS		P value
	n	%	n	%	n	%	
ENDOPHTH-ALMITIS Present	0	0%	2	4.9%	1	5.9%	1.000
Absent	8	100%	39	95.1%	16	94.1%	

ASSOCIATION BETWEEN RELATIVE AFFERENT PUPILLARY DEFECT AND POOR VISION & BLINDNESS

	POOR VISION		BLINDNESS		OTHERS		Pvalue
	n	%	n	%	n	%	
RAPD Present	7	25.9%	26	44.1%	9	13.0%	0.000
Absent	20	74.1%	31	52.5%	60	87.0%	
Could not be assessed	0	0%	2	3.4 %	0	0%	

ASSOCIATION BETWEEN INTRAOCULAR FOREIGN BODY AND POOR VISION & BLINDNESS

	POOR VISION		BLINDNESS		OTHERS		Pvalue
	n	%	n	%	n	%	
IOFB present	3	11.1%	15	25.4%	6	8.7%	0.034
Absent	24	88.9%	44	74.6%	63	91.3%	

ASSOCIATION BETWEEN CORNEAL TEAR IN THE VISUAL AXIS AND POOR VISION & BLINDNESS

	POOR VISION		BLINDNESS		OTHERS		Pvalue
	n	%	n	%	n	%	
CORNEAL TEAR IN VISUAL AXIS	9	33.3%	29	49.2%	12	17.4%	0.001
NOT IN VISUAL AXIS	18	66.7%	30	50.8%	57	82.6%	

ASSOCIATION BETWEEN LENS MATTER ASPIRATION AND POOR VISION & BLINDNESS

	POOR VISION		BLINDNESS		OTHERS		P value
	n	%	n	%	n	%	
LMA done	1	3.7%	4	6.8%	5	7.2%	1.000
Not done	26	96.3%	55	93.2%	64	92.8%	

DISCUSSION

AGE DISTRIBUTION OF TRAUMA IN CHILDREN

The study conducted at Birmingham, UK, included children under 16 years of age with open globe injuries and attending the Birmingham and Midland Eye Hospital from September 1979 to August 1989 .The study included 96 children. The mean age in their study was 9 years and 4 months.[6]

The retrospective study done at Wilmer Eye Institute, The Johns Hopkins Hospital, Baltimore included 218 children aged less than or equal to 14 years. The study had 2 groups. Group A were children presenting between January 1970 and December 1981 and group B were children presenting from December 1985 to January 1993. The mean age was same in both groups. Overall mean age was 8.2 years.[7]

The retrospective study done at National Cheng Kung University Hospital in Taiwan included children 15 years or younger with ocular injuries and presented from June 1988 to May 2006. The study included 156 children with mean age of 7.1+/- 0.3 years. The age group range was 1.1 to 15.0 years. Mean age for boys was 7.3+/- 4.4 years. The mean age for girls was 6.7+/- 4.3 years.[1]

Another retrospective study done at Ludhiana included 80 children below 15 years age. The children were divided into 3 groups: 0 to 5 years, 6 to 10 years and 11 to 15 years. 40% of the children belonged to the 6 to 10 years age group.[2]

In our study, the mean age is 8.66 years. The mean age among boys is 9.04 years. The mean age among girls is 7.66 years. The majority of children were from 5 to 14 years age group. This is the age group (school going) when children try to do things on their own but they do not have adequate maturity to make decisions on their own and are also influenced by their peer groups to do adventurous activities. They tend to play with potentially hazardous objects like wooden sticks, crackers, etc without understanding the potential risks.

GENDER DISTRIBUTION

The study done at Birmingham had a ratio of 4:1 for boys: girls.

The study done at Johns Hopkins Hospital had 87% boys in group A and 75% girls in group B. There were 5 times as many boys than girls (5:1 ratio).[6]

The study done at Taiwan also had more number of boys. The boy: girl ratio was 1.8:1 for children from 0 to 5 years, 2.3:1 for those who were 6 to 10 years, and 2.5: 1 for those who were 11 to 15 years old. The overall ratio of boys to girls was 2.1:1.[1]

The predominance of boys is seen even in our study. The ratio of boys to girls in our study is 2.6:1. The higher incidence of trauma in boys is probably because of the increased physical activity and aggressive behavior common among boys.

EYE AFFECTED

Among the children included in the study done at The Johns Hopkins Hospital, involvement of either eye was equal. The right eye was involved in 55% of children and the left eye was involved in 45% of the children.[7]

Among the children included in the study done at National Cheng Kung University Hospital in Taiwan, right eye alone was affected in 48.7% and left eye alone was affected in 51.3%.[1]

In our study 50.0% had right eye injured and 49.4% had left eye injured 0.6% (one child) had both eyes injured.

OBJECT CAUSING INJURY

Various studies have analyzed the frequencies of various objects causing open globe injuries. The study done at The Johns Hopkins Institute showed similar pattern in both the groups. In group A, 49% sustained injury with a sharp object and 34% were caused by missile. In group B, 66 % sustained injury with a sharp object and 25% with missile.[7]

In the study done at Taiwan unspecified sharp object caused 16.7% of injuries followed by scissors which caused 13.5% of injuries. This was followed by pencils and pens causing 12.2% of injuries.[1]

The study done in Malawi, south- east Africa, from January 1976 to December 1977 had 71 children who were below 20 years. The causes for open globe injuries in this

study are as follows: fire wood 18(25.4%), blunt instruments 11(15.5%), sharp instruments7 (9.9%), fights 7(9.9%), road accidents3(4.2%),industrial accidents 3(4.2%), burns 2 (2.8%), falls 2(2.8%), sports accidents 2(2.8%), others 11(15.5%) and not recorded were 4(5.6%).[43]

The study done at Ludhiana showed that ocular injuries occurring during sports was the most common mechanism (52.8%) resulting in open globe injuries among children. The study also showed that the main sports resulting in trauma were playing with bow and arrow and gillidanda(47.2%). Domestic accidents resulted in 31.5% of injuries. Fire crackers caused 15.7% of injuries.[2]

The study done at AIIMS, New Delhi included 204 children, showed that the most common object causing injury was bow and arrow(15.2%) followed by household appliances (14.%).[41]

Our study shows that wooden stick (kutchi), or thorn is the predominant object causing open globe injuries(41.6%) . This is because of easy availability and accessibility of wooden sticks at home and in the surroundings. The wooden sticks contain organic matter and are high risk for causing ocular infection. The second most common object causing trauma is metal pieces (17.3%). The third most common object causing injury is glass pieces (7.1%). The fourth most common object causing injury is fire crackers (6.4%).Unknown objects accounted for 4.5% of injuries.

ADULT SUPERVISION

A study done at Egypy including 150 children aged 16 years or younger showed that 92% of the children were without adult supervision when the trauma occurred. [37]

In our study only one child was under adult supervision when the trauma occurred.

RELATIVE AFFERENT PUPILLARY DEFECT

The presence of relative afferent pupillary defect has been associated with poor visual outcome in various studies.

A retrospective study done to evaluate the factors affecting the visual outcome after surgical repair in 669 patients with open globe injuries at Shri Ganapathi Netralaya at Jalna, Maharashtra showed that relative afferent pupillary defect had a significant association with presence of relative afferent pupillary defect.[25]

In our study 42 children had relative afferent pupillary defect. 112 children had no relative afferent pupillary defect. In two children it could not be assessed as the children were having pain and were not co-operative.

ENDOPHTHALMITIS

Endophthalmitis following ocular trauma is a less common but serious complication. It important to identify the high risk cases and keep the children under close follow up as they may not be able to recognize worsening of symptoms. Successful management of endophthalmitis depends on early diagnosis and and prompt treatment with intravitreal and systemic antibiotics.[44,45,50, 51]

The risk factors for endophthalmitis were studied in a retrospective analysis of 72 children with open globe injuries at a tertiary care center at Chandigarh. Bow and arrow injuries had a significantly high incidence of endophthalmitis (75%).

Endophthalmitis was also associated with delay in repair of open globe injuries. Of the 72 children, 22 children presented beyond 72 hours of injury, of which 18 children developed endophthalmitis(81.82%).[26]

Another retrospective study done at 15 tertiary referral centers at China, which included 4968 eyes of 4865 patients with open globe injuries and presenting to these centers over 5 years(January 2001 to December 2005). The incidence of endophthalmitis in the study was 11.91%(571 eyes). The study also showed that there was significant association between endopthalmitis and tissue prolapsed (P=0.00001), posterior segment involvement(p=0.2362) and primary repair done more than 24 hours after injury(P=0.0003).[28]

In our study 3 children developed endophthalmitis(1.92%). Two children had injury with vegetable matter and one had injury with pencil point. All three of them had received intra vitreal antibiotics. Our study also showed that there is was no statistically significant association between vegetable matter causing injury and

endophthalmitis. There was no statistically significant association between presence of intraocular foreign body and endophthalmitis. There was also no statistically significant association between vitreous loss and endophthalmitis.

All the 3 children who developed endophthalmitis presented more than 48 hours after injury.

INTRA OCULAR FOREIGN BODY

In the study done at The Johns Hopkins Hospital, the presence of an intraocular foreign body was an indicator of poor visual outcome in group A (children with open globe injuries presenting from January 1970 to December 1981) but not in group B (children with open globe injuries presenting from December 1985 to January 1993).[7]

The study done in Taiwan showed that the presence of an intraocular foreign body was associated with poor visual outcome and the association was statistically significant (P=0.01).[1.]

The study done at Gulhane Military Academy, Turkey, showed that the presence of intraocular foreign was not associated with poor vision(p=0.076).[47]

A study done at the Post Graduate Institute of Medical Education and Research, Chandigarh which included 72 children with open globe injuries, had 10 (13.89%) cases with intraocular foreign body. One was in the anterior segment, 8 in the posterior segment and one in the orbit. Foreign bodies included eyelash (n=3), wooden splint (n=4), stone (n=1) and iron (n=2).[26]

In our study, intraocular foreign body was present in 24 cases. There was no significant association between the presence of intraocular foreign body and

endophthalmitis (P=1.000). Our study also showed that there was significant association between poor visual acuity and the presence of foreign body (p=0.34).

TYPES OF INJURY

50,070 children attended OPD at the Department of Ophthalmology at our hospital from August 2007 to January 2012. 216 children had open globe injuries (0.43%). Medical records of 156 children could be retrieved (72.22%).

The retrospective study done on 80 children at Ludhiana had 49 children with corneal tear, 33 children with corneoscleral tear and 7 children with sclera tear.[2]

In our study 71.5% had corneal tear, 8.33% had sclera tear, 15.38% had corneoscleral tear and 5.1% had limbal tear.

PRIMARY SURGICAL INTERVENTION

A retrospective study conducted at the University Eye Clinic, Germany included 38 children with open globe injuries who were 16 years or younger. All of them underwent primary surgical repair. Along with the primary repair some children needed additional procedures. The details of children undergoing additional procedures along with primary repair are as follows:

One child underwent vitrectomy with SF6 (2.6%).

5 children underwent lensectomy (13.1%).

2 children underwent vitrectomy, pars plana lensectomy with SF6(5.2%).

One child underwent vitrectomy with silicone oil(2.6%). [27]

Among the 156 children included in the retrospective study at National Cheng Kung University Hospital at Taiwan, primary wound repair was done in 138 children (88.5%). The other primary treatment modalities done were

1. Anterior chamber wash - 17 (10.9)
2. Iridoplasty -2(1.3)
3. Trabeculectomy -1(0.6%)
4. Lens matter aspiration-35(22.4)
5. IOL implantation -18(11.5)
6. Vitrectomy-16(10.3)
7. Retinal detachment – treatment or prophylaxis- 12(7.7)
8. Intracameral/ intravitreal antibiotics-22(14.1)
9. IOFB removal-16(10.3)
10. Orbital fracture repair-2(1.3)[1]

In our study all the patients underwent primary surgical repair. Along with the primary repair, 52 children underwent lens matter aspiration, 6 children underwent partial anterior vitrectomy , 25 children underwent lens matter aspiration and partial anterior vitrectomy, one child underwent lens matter aspiration alone, 2 children underwent evisceration and one child underwent enucleation.

SECONDARY SURGICAL INTERVENTION

In the retrospective study done at University Eye Clinic, Germany, 19 children underwent secondary surgical procedures. Vitrectomy with SF6 was done in 2 cases (5.3%). Repeat vitrectomy with silicone oil was done in 1(5.3%).

Vitrectomy , pars plana lensectomy with SF6 was done in 6(31.6%). Vitrectomy, pars plana lensectomy with silicone oil was done in 4 children(21.1%). vitrectomy , pars plana lensectomy, encircling band with silicone oil was done in 1 child(5.3%). Lensectomy alone was done in 3 children(15.8%).

In the retrospective study done on 156 children at The National Cheng Kung University, Taiwan, 27 children underwent secondary surgical procedures. 13 children had undergone IOL implantation(41.9%), 5 had anterior vitrectomy(16.1%), 3 had iridoplasty(9.7%), 3 had pars plana vitrectomy(9.7%) and 3 had penetrating keratoplasty(9.7%).[1]

In our study, 59 children had undergone secondary surgical procedures.

The details are as follows:

7 children had lens matter aspiration alone

17 had IOL implantation

6 had lens matter aspiration, primary posterior capsulotomy, partial anterior vitrectomy and IOL insertion

9 had resuturing

3 had vitreous tap with intravitreal antibiotic injection

5 had vitrectomy with intravitreal antibiotics

1 had evisceration

8 underwent other secondary surgical procedures.

POST-OPERATIVE COMPLICATIONS

In the study done by the National Chen Kung University Hospital at Taiwan, the various complications that occurred during the post operative period in children with trauma were: 88 children had corneal opacity/ scar(56.4%), 4 had secondary glaucoma(2.6%),1 had distorted pupil (0.6%), 6 had aphakia(3.8%), 1 had IOL protrusion(0.6%), 5 had after cataract(3.2%), 2 had vitreous opacity(1.3%), 3 had retinal detachment(1.9%), 1 had choroidal detachment(0.6%),1 had macular folds(0.6%), 1 had optic neuropathy/atropy(1.3%), 5 had exotropia(3.2%) and 11 had phthisis bulbi (7 .7%).[1]

The various complications that occurred in the children in our study are:

Glaucoma 5(7.6%), retinal detachment 6(9.1%), suture infiltrate 10(15.2%), cataract 7(10.6), endophthalmitis 2(3.0%), phthisis 9(13.6%), hypotony 2(3%), fibrous

proliferations 4(6.1%), macular scar 1(1.5%) ,squint 3(4.5%), amblyopia 4(6.1%) , iris cyst 2(3.0%), endophthalmitis and phthisis 1(1.5%), cataract and macular scar 1(1.5%), high IOP and iris cyst 1(1.5%) ,PVR changes and corneal ulcer 1(1.5%), hypotony and phthisis 1(1.5%), suture infiltrate and retinal detachment1(1.5)%, squint and retinal detachment1(1.5%), retinal detachment and phthisis 1(1.5%),cataract and high IOP 1(1.5%).

VISUAL OUTCOME

The retrospective study done at Birmingham on children with open globe injuries showed that corneal tears were associated with poor visual outcome when

1. Visual axis is involved
2. There was resultant scarring causing astigmatism
3. Corneal tear involved more than one-quarter of the corneal diameter
4. Non- compliance with spectacles or patching in patients younger than 8 years.[6]

Our study has shown that there was significant association between poor vision and blindness and

1. Corneal tear involving the pupillary axis
2. Presence of relative afferent pupillary defect
3. Presence of intraocular foreign bod

CONCLUSIONS

50,070 children attended OPD at the Department of Ophthalmology at our hospital from August 2007 to January 2012. 216 children had open globe injuries (0.43%). Medical records of 156 children could be retrieved and analysed (72.22%).

AGE: The overall mean age is 8.66 years. The mean age among boys is 9.04 years. The mean age among girls is 7.66 years. The majority of children were from 5 to 14 years age group.

GENDER: The predominance of boys is seen. The ratio of boys to girls in our study is 2.6:1.

EYE AFFECTED: 50.0% of the children had right eye injured, 49.4% had left eye injured and 0.6% (one child) had both eyes injured.

OBJECT CAUSING INJURY: Our study shows that wooden stick (kutchi), or thorn is the predominant object causing open globe injuries(41.6%) . The second most common object causing trauma is metal piece (17.3%). The third most common object causing injury is glass piece (7.1%). The fourth most common object causing injury is fire crackers (6.4%). Unknown objects accounted for 4.5% of injuries.

RELATIVE AFFERENT PUPILLARY DEFECT: There was significant association between relative afferent defect and poor vision & blindness.

INTRAOCULAR FOREGIN BODY: In our study, intraocular foreign body was present in 24 cases. There was no significant association between the presence of intraocular foreign body and endophthalmitis (P=1.000). Our study showed that there was significant association between poor visual acuity and the presence of foreign body (P =0.34).

TYPE OF INJURY: 71.5% of children had corneal tear, 8.33% had sclera tear, 15.38% had corneoscleral tear and 5.1% had limbal tear.

There was significant association between corneal tear in the pupillary axis and poor vision (P= 0.001).

PRIMARY SURGICAL PROCEDURE: In our study all the patients underwent primary surgical repair. Along with the primary repair, 52 children underwent lens matter aspiration , 6 children underwent partial anterior vitrectomy , 25 children underwent lens matter aspiration and partial anterior vitrectomy, one child underwent lens matter aspiration alone, 2 children underwent evisceration and one child underwent enucleation.

SECONDARY SURGICAL PROCEDURES: In our study, 59 children had undergone secondary surgical procedures. The details are as follows:

7 children had lens matter aspiration alone, 7 had IOL implantation, 6 had lens matter aspiration, primary posterior capsulotomy, partial anterior vitrectomy and IOL insertion, 9 had resuturing, 3 had vitreous tap with intravitreal antibiotic injection, 5

had vitrectomy with intravitreal antibiotics, 1 had evisceration and 8 underwent other secondary surgical procedures.

POST OP COMPLICATIONS: The various complications that occurred in the children in our study are:

Glaucoma 5(7.6%), retinal detachment 6(9.1%), suture infiltrate 10(15.2%), cataract 7(10.6), endophthalmitis 2(3.0%), phthisis 9(13.6%), hypotony 2(3%), fibrous proliferations 4(6.1%), macular scar 1(1.5%) ,squint 3(4.5%), amblyopia 4(6.1%) , iris cyst 2(3.0%), endophthalmitis and phthisis 1(1.5%), cataract and macular scar 1(1.5%), high IOP and iris cyst 1(1.5%) ,PVR changes and corneal ulcer 1(1.5%), hypotony and phthisis 1(1.5%), suture infiltrate and retinal detachment1(1.5)%, squint and retinal detachment1(1.5%), retinal detachment and phthisis 1(1.5%),cataract and high IOP 1(1.5%).

ENDOPHTHALMITIS: In our study 3 children developed endophthalmitis(1.92%). Two children had injury with vegetable matter and one had injury with pencil point. All three of them had received intravitreal antibiotics. Our study also showed that there is was no statistically significant association between vegetable matter causing injury and endophthalmitis. There was no statistically significant association between presence of intraocular foreign body and endophthalmitis. There was also no statistically significant association between vitreous loss and endophthalmitis. All the 3 children who developed endophthalmitis presented more than 48 hours after injury.

VISUAL OUTCOME: Our study has shown that there was significant association between poor vision and blindness and

1. Corneal tear involving the pupillary axis
2. Presence of relative afferent pupillary defect
3. Presence of intraocular foreign body.

LIMITATIONS

1. Children who had surgery done elsewhere and had come to our hospital for further management were not included in the study.
2. The retrospective study is inherently subject to inaccuracies in terms of data collection and interpretation.
3. Stereopsis was not assessed.

CLINICAL RESEARCH FORM

PEADIATRIC TRAUMA STUDY PROFILE

NAME :

AGE:

HOSPITAL NO :

SEX: M / F

PLACE (VILLAGE):

DISTRICT:

OCCUPATION OF FATHER:

MONTHLY INCOME:

EYE: R/L

PARENTERAL GUIDANCE : PRESENT / NOT PRESENT

DATE OF ADMISSION: DATE OF DISCHARGE:

COST OF RX:

PLACE OF INJURY: INDOOR / OUTDOOR/FALL/AT PLAY/RTA/OTHERS

DATE & TIME OF INJURY:

DATE & TIME OF PRESENTATION TO CASUALTY:

DATE &TIME OF SURGERY:

OBJECT OF INJURY : WOODEN STICK / THORN / CRACKER / METAL PIECE / GLASS / STONE / UNKNOWN /OTHERS _____

RAPD: PRESENT/ ABSENT

INJ.TT: GIVEN/NOT GIVEN

SITE AND TYPE OF INJURY:

CONJUNCTIVA -TEAR / SCH

CORNEAL TEAR- PUPILLARY AXIS INVOLVED / NOT INVOLVED/ LIMBAL TEAR/ LENGTH___MM

ANTERIOR SEGMENT: HYPOPYON / HYPHEMA/ IRIS PROLAPLSE/IRIDODIALYSIS

SCLERAL TEAR <5MM FROM LIMBUS /> 5MM LENS: CLEAR/ AC RUPTURE/ PC RUPTURE

POSTERIOR SEGMENT: VH / VITREOUS CELLS /VIT LOSS

RETINA: RD/OTHERS

IOFB: +/-

X RAY/CT SCAN/MRI: DONE / NOT DONE

INJ CIPLOX GIVEN/NOT GIVEN

INTERVENTION DONE: CT SUTURING/ST SUTURING/BOTH CT &ST SUTURING/IRIS EXCISION OR ABSCISSION /LMA/PAV/IOFB REMOVAL

VITREOUS TAP: TAKEN/ NOT TAKEN

INTRA VITREAL ANTIBIOTICS: GIVEN (V/C/A)/ NOT

VISION :

AT PRESENTATION (UNAIDED) : RE LE

1ST POST OP WEEK (BCVA) : RE LE

1 MONTH POST OP (BCVA) : RE LE

6 MONTHS POST OP (BCVA) : RE LE

POST OP COMPLICATIONS: GLAUCOMA/RD /OTHERS_____

SECONDARY INTERVENTION: NOT DONE/LMA/ IOL IMPLANTATION/OTHER_____

DATE OF SECONDARY SURGERY:

ASTIGMATIC/APHAKIC CORRECTION: CL/GLASSES/NOT ADVICED

AMBLYOPIA RX: OCCLUSION GIVEN/NOT GIVEN

DURATION: FROM____TO____(AGE)____

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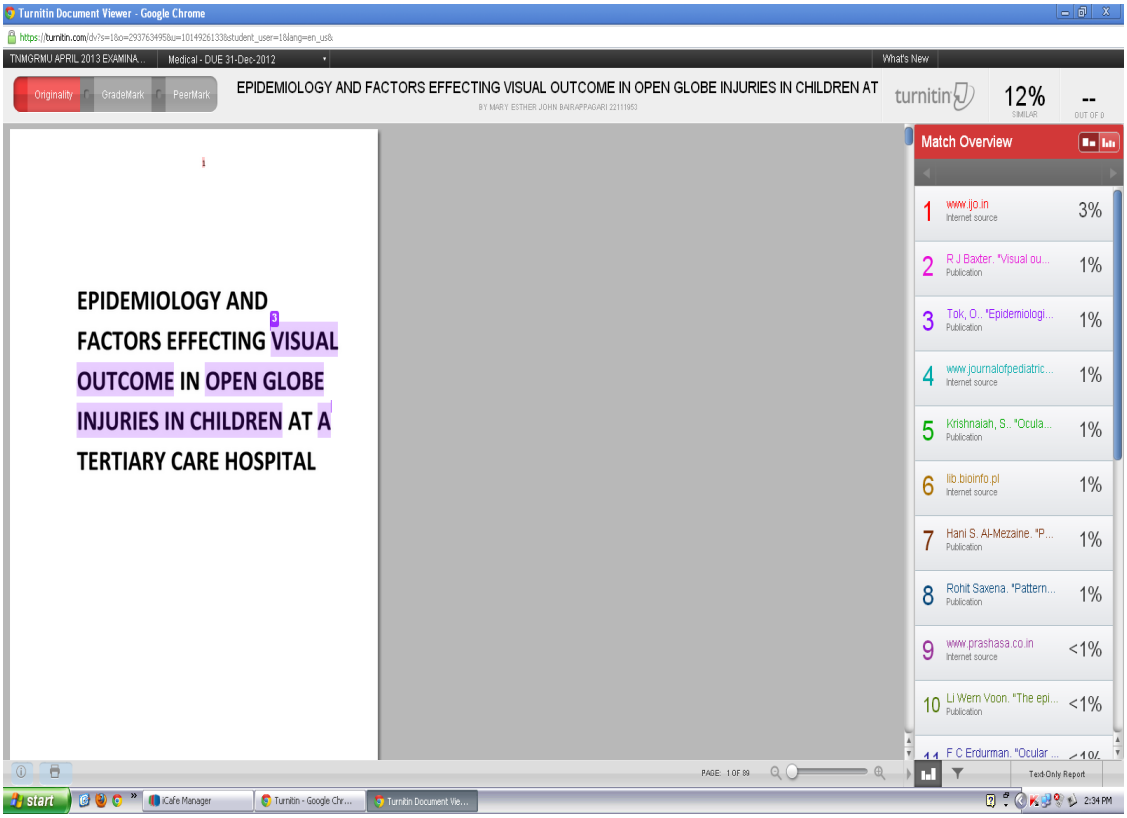
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Dr.Gagandeep Kang, MD, Ph.D, FRCPath
Secretary, Research Committee, IRB
Additional Vice Principal(Research)

January 14, 2012

Dr. Mary Esther John
PG Registrar
Department of Ophthalmology
Christian Medical College
Vellore 632 002

Sub: **FLUID Research grant project NEW PROPOSAL :(PERMISSION ONLY)**
Epidemiology and factors effecting visual outcome in open globe injuries in children at a tertiary care hospital
Dr Mary Esther John, PG Registrar, Ophthalmology, Dr Renu Raju, Dr. Padma Paul, Dr Deepa John, Ophthalmology.

Ref: IRB Min. No. 7664 dated 18.11.2011

Dear Dr. John,

The Institutional Review Board (Blue, Research and Ethics Committee) of the Christian Medical College, Vellore, reviewed and discussed your project entitled "Epidemiology and factors effecting visual outcome in open globe injuries in children at a tertiary care hospital" on November 18, 2011.

The Committees reviewed the following documents:

1. Format for application to IRB submission
2. Proforma
3. Information Sheet (English)
4. Informed Consent Form (English and Tamil)
5. Cvs of Drs. Mary Esther John, Deepa John, Padma Paul.
6. A CD containing document 1 – 4

The following Institutional Review Board (Ethics Committee) members were present at the meeting held on November 18, 2011 in the CREST/SACN Conference Room, Christian Medical College, Bagayam, Vellore- 632002.

Name	Qualification	Designation	Other Affiliations
Dr. B.J.Prashantham	MA (Counseling), MA	Chairperson(IRB)&	Non-CMC

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Chairperson, Research Committee &
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Dr.Gagandeep Kang, MD, Ph.D, FRCPath
Secretary, Research Committee, IRB
Additional Vice Principal(Research)

	(Theology), Dr Min(Clinical)	Director, Christian Counselling Centre	
Mr. Harikrishnan	BL	Lawyer	Non-CMC
Mrs. S. Pattabiraman	BSc, DSSA	Social Worker, Vellore	Non-CMC
Mr. Samuel Abraham	MA, PGDBA, PGDPM, M.Phil, BL.	Legal Advisor, CMC.	
Dr. Gagandeep Kang	MD, PhD, FRCPath.	Secretary IRB (EC)& Dy. Chairperson (IRB), Professor of Microbiology & Addl. Vice Principal (Research), CMC.	

We approve the project to be conducted as presented.

The Institutional Ethics Committee expects to be informed about the progress of the project, any serious adverse events occurring in the course of the project, any changes in the protocol and the patient information/informed consent and requires a copy of the final report.

Yours sincerely,

Dr. Alfred Job Daniel
Principal& Chairperson (Research Committee)
Institutional Review Board

Chairperson (Research Committee) &
Principal
Christian Medical College
Vellore - 632 002, Tamil Nadu, India

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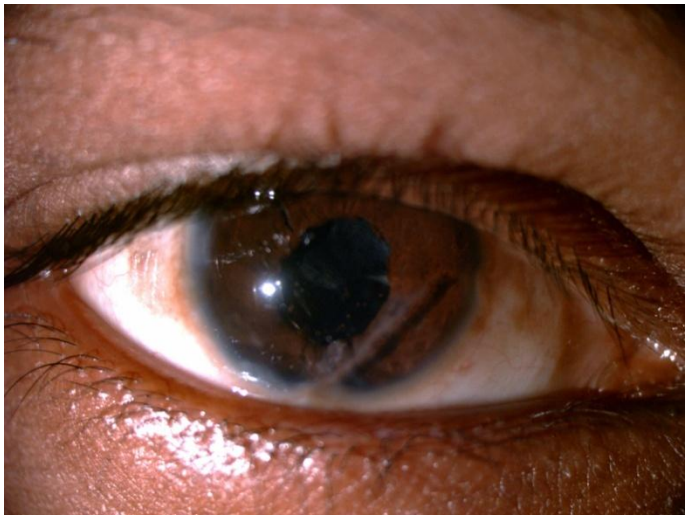

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